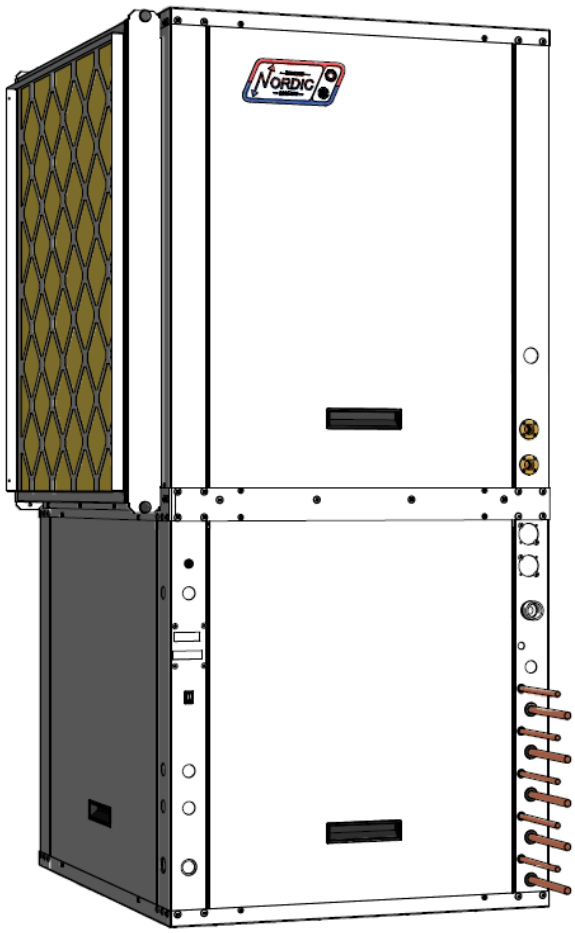
MARITIME GEOTHERMAL LTD.

# Installation and Service Manual

## NORDIC® DX-Series

**Single-Stage R410a**
**Model Sizes 25-65**

## *Direct Expansion Heat Pumps*



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## SAFETY PRECAUTIONS

**WARNING:** **Ensure all access panels are in place and properly secured before applying power to the unit. Failure to do so may cause risk of electrical shock.**

**WARNING:** **Before performing service or maintenance on the heat pump system, ensure all power sources are DISCONNECTED. Electrical shock can cause serious personal injury or death.**

**WARNING:** **Heat pump systems contain refrigerant under high pressure and as such can be hazardous to work on. Only qualified service personnel should install, repair, or service the heat pump.**

**CAUTION:** **Safety glasses and work gloves should be worn at all times whenever a heat pump is serviced. A fire extinguisher and proper ventilation should be present whenever brazing is performed.**

**CAUTION:** **Venting refrigerant to atmosphere is illegal. A proper refrigerant recovery system must be employed whenever repairs require removal of refrigerant from the heat pump.**

## MODEL NOMENCLATURE

**DX—65—HACW—P—1S—L—SDETV—xx**

**Series:**
DX = Direct Expansion

**Nominal Size:**
25 = 2 Ton
45 = 3 Ton
55 = 4 Ton
65 = 5 Ton

**Functions:**
H = Heating
AC = Active Cooling
W = Domestic Hot Water

**Refrigerant:**
P = R410a

**Voltage Code:**
1 = 230-1-60 VAC
2 = 208-3-60 VAC
6 = 220-1-50 VAC
7 = 380-3-50 VAC

**Compressor Stages:**
S = 1 Stage

**Revision:**
01, 02 etc.

**Case Style:**
V = Vertical

**Fan Discharge:**
T = Top
S = Side

**Fan Motor:**
E = ECM (Variable Speed)

**Fan Type:**
D = Direct Drive

**Air Coil:**
S = Standard

**Extra Loop:**
= No
L = Yes

## APPLICATION TABLE

| SIZE | FUNCTION | REFRIGERANT | VOLTAGE | STAGES | EXTRA LOOP | FAN/ CASE | REVISIONS | |
|---|---|---|---|---|---|---|---|---|
| 25 | HW | P | 1 | S | BLANK or L | SDELF or SDERF | N/A | |
| | | | 2 | S | | | N/A | |
| | | | 6 | S | | | N/A | |
| | | | 7 | S | | | N/A | |
| | HACW | | 1 | S | | | 05 | |
| | | | 2 | S | | | 05 | |
| | | | 6 | S | | | 05 | |
| | | | 7 | S | | | 05 | |
| 45 | HW | P | 1 | S | BLANK or L | SDELF or SDERF | N/A | |
| | | | 2 | S | | | N/A | |
| | | | 6 | S | | | N/A | |
| | | | 7 | S | | | N/A | |
| | HACW | | 1 | S | | | 05 | |
| | | | 2 | S | | | 05 | |
| | | | 6 | S | | | 05 | |
| | | | 7 | S | | | 05 | |
| 55 | HW | P | 1 | S | BLANK or L | SDELF or SDERF | N/A | |
| | | | 2 | S | | | N/A | |
| | | | 6 | S | | | N/A | |
| | | | 7 | S | | | N/A | |
| | HACW | | 1 | S | | | 05 | |
| | | | 2 | S | | | 05 | |
| | | | 6 | S | | | 05 | |
| | | | 7 | S | | | 05 | |
| 65 | HW | P | 1 | S | BLANK or L | SDELF or SDERF | N/A | |
| | | | 2 | S | | | N/A | |
| | | | 6 | S | | | N/A | |
| | | | 7 | S | | | N/A | |
| | HACW | | 1 | S | | | 05 | |
| | | | 2 | S | | | 05 | |
| | | | 6 | S | | | 05 | |
| | | | 7 | S | | | 05 | |

This manual applies only to the models and revisions listed in this table

# Table of Contents


**TABLES, DIAGRAMS & DRAWINGS: ..... PAGE 5**

**INSTALLATION INFORMATION: ..... PAGE 6**
- **Unit description: ..... Page 6**
- **Unpacking the unit: ..... Page 6**
- **Optimum Placement: ..... Page 6**
- **Electrical Connections: ..... Page 6**
- **Thermostat Requirements: ..... Page 6**
- **Fan Motor: ..... Page 6**
- **Control Transformer: ..... Page 7**
- **Safety Controls: ..... Page 7**
- **Domestic Hot Water Connections: ..... Page 7**

**DIRECT EXPANSION UNIT OPERATION: ..... PAGE 9**
- **Refrigeration: ..... Page 9**
- **Control Board: ..... Page 9**

**SIZING AND DUCTWORK: ..... PAGE 12**
- **Heat Pump Sizing: ..... Page 12**
- **Duct Systems - General: ..... Page 12**
- **Duct Systems - Grill Layout: ..... Page 12**
- **Thermostat Location: ..... Page 13**
- **Plenum Heater (Optional): ..... Page 13**
- **Condensate Drain: ..... Page 13**
- **Duct Sizing Guide: ..... Page 15**

**DIRECT EXPANSION LOOP CONNECTION AND CHARGING: ..... PAGE 16**
- **Line Set Interconnect Tubing: ..... Page 16**
- **Pipe Insulation: ..... Page 16**
- **Silver Soldering Line Sets: ..... Page 16**
- **Pressure Testing: ..... Page 16**
- **Vacuuming the System: ..... Page 16**
- **Charging the System: ..... Page 16**

**STARTUP PROCEDURE: ..... Page 18**
- **Pre-start Inspection: ..... Page 18**
- **Unit Startup: ..... Page 19**
- **Startup Record: ..... Page 20**

**HEATING TXV ADJUSTMENT: ..... Page 21**
- **Adjustment Procedure: ..... Page 21**
- **Heating TXV Adjustment Record: ..... Page 22**

**GENERAL MAINTENANCE: ..... PAGE 23**

**TROUBLESHOOTING GUIDE: ..... PAGE 24**
- **Repair Procedures: ..... Page 34**
- **Refrigeration Circuit Diagrams: ..... Page 35**

**MODEL SPECIFIC INFORMATION: ..... PAGE 37**
- **Standard Capacity Ratings: ..... Page 37**
- **Capacity Ratings: ..... Page 38**
- **Electrical Tables: ..... Page 42**
- **Electrical Diagrams-HW (230-1-60): ..... Page 43**
- **Electrical Diagrams-HACW (230-1-60): ..... Page 43**
- **Case Details: ..... Page 47**

**APPENDIX A: ECM Fan Airflow Tables: ..... PAGE 49**

**WARRANTY INFORMATION: ..... PAGE 52**

# Tables, Diagrams and Drawings

## TABLES


Table 1 - Control Signal Description: ..... Page 5
Table 2 - Airflow Selections: ..... Page 6
Table 3 - Cooling Mode Loop Sequences: ..... Page 9
Table 4 - Cooling Loop Configuration: ..... Page 9
Table 5 - RS232 Port Configuration: ..... Page 10
Table 6 - Control Board Commands: ..... Page 10
Table 7 - Control Board Default Settings: ..... Page 10
Table 8 - Heat Pump Size vs. Heated Area: ..... Page 12
Table 9 - Heat Pump Size vs. Hot Air Grills: ..... Page 12
Table 10 - Plenum Heater Sizing: ..... Page 13
Table 11 - Duct Sizing Guide: ..... Page 15
Table 12 - DX Charge Chart: ..... Page 16
Table 13 - Heating TXV Adjustment Record Column Descriptions: ..... Page 21

Table 14 - Standard Capacity Ratings - Heating 60Hz: ..... Page 37
Table 15 - Standard Capacity Ratings - Cooling 60Hz: ..... Page 37
Table 16 - Heat Pump Electrical Information (230-1-60): ..... Page 42
Table 17 - Heat Pump Electrical Information (208-3-60): ..... Page 42
Table 18 - Heat Pump Electrical Information (220-1-50): ..... Page 42
Table 19 - Heat Pump Electrical Information (380-3-50): ..... Page 42


## DIAGRAMS


Case Details: ..... Page 47


## DRAWINGS


000970PDG - Single Unit Connection to DHW Pre-Heat Tank (Brass FPT): ..... Page 8
000310CDG - NCB Laptop Communication Cable: ..... Page 11
000606CDG - Typical Duct and Condensate Connections (Vertical Case): ..... Page 14
001638PDG - DX Line Set Interconnect Tubing Installation (Modular Design-R410a): ..... Page 17
001576RCD - DX-Series Refrigeration Circuit Diagram—Heating Mode: ..... Page 35
001577RCD - DX-Series Refrigeration Circuit Diagram—Cooling Mode: ..... Page 36
001563SCH - DX-**-H*-P-1S-*DE** Schematic Diagram: ..... Page 43
001564ELB - DX-**-H*-P-1S-*DE** Electrical Box Diagram: ..... Page 44
001561SCH - DX-**-HAC*-P-1S-*DE** Schematic Diagram: ..... Page 45
001562ELB - DX-**-HAC*-P-1S-*DE** Electrical Box Diagram: ..... Page 46

## UNIT DESCRIPTION

The DX-Series unit is a high efficiency single stage direct expansion (DX) heat pump with R410a refrigerant. It extracts and rejects heat from the earth via direct contact with copper loops, eliminating the need for a secondary heat exchanger and associated components.

Direct expansion units require less “loop” per ton and are more efficient than conventional ground loop systems. The reduced thermal resistance between the earth and the refrigerant circuit provides better heat transfer, resulting in a higher suction pressure and increased output.

An electrically commutated (ECM) fan with several speed options is standard. The motor has a soft start function for improved efficiency and reduced wear.

The unit has several key features that are described in the specifications document for the particular heat pump. Please request a copy if desired or visit **www.nordicghp.com**

## UNPACKING THE UNIT

When the heat pump reaches its destination it should be unpacked to determine if any damage has occurred during shipment. Any visible damage should be noted on the carrier's freight bill and a suitable claim filed at once.

The heat pump is well constructed and every effort has been made to ensure that it will arrive intact, however it is in the customer's best interest to examine the unit thoroughly when it arrives.

## OPTIMUM PLACEMENT

For air units, to achieve the greatest efficiency, the heat pump should be centrally located in the home with respect to the conditioned space. This design provides the utmost in economy and comfort and usually can be accomplished in harmony with the design of the home. A heating system cannot be expected to produce an even warmth throughout the household when it is located at one end of the structure and the warm air is transmitted with uninsulated metal ductwork.

If possible the access panels should remain clear of obstruction for a distance of **two feet** to facilitate servicing and general maintenance.

Raising the heat pump off the floor a few inches is generally a good practice since this will prevent rusting of the bottom panel of the unit. We recommend that the heat pump be placed on a piece of 2" thick styrofoam. The styrofoam will smooth out any irregularities in the cement floor and deaden any compressor noise emitted from the bottom of the cabinet.

NORDIC® heat pumps have an air-filter rack which can be installed with the removable end (where the filter is inserted) on either side to facilitate changing the filter.

## ELECTRICAL CONNECTIONS

The heat pump has a concentric 1.093” / 0.875” knockout for power supply connection to the electrical box, as well as one for connection to the circulator pump module for ground loop applications. There are two 1/2” openings with plastic grommets (grommet hole is 3/8”) in the upper section of the electrical box, one for the thermostat connections, and one for the optional plenum heater connections.

A schematic diagram and electrical box layout diagram (ELB) can be found inside the electrical box cover of the unit as well as in the Model Specific section of this manual. The Electrical Tables in the Model Specific section and the ELB diagram contain information about the size of wire for the connections, as well as the recommended breaker size. **A properly qualified electrician should be retained to make the connections to the heat pump and associated controls. The connections to the heat pump MUST CONFORM TO LOCAL CODES.**

## THERMOSTAT REQUIREMENTS

The DX-Series unit requires a two-stage heating and one stage cooling thermostat with relay outputs for proper operation. **Triac output thermostats are incompatible with the control board in the heat pump.** The stages are S1 = Compressor, S2 = electric auxiliary (heating only). One can be purchased with the unit, or other thermostats with the same number of stages can be used. The electrical box diagram (ELB) on the electrical box cover and **TABLE 1** provide a description of the signals.

**TABLE 1 - Control Signal Description**

| Signal | Description |
|---|---|
| C | 24VAC Common (Ground) |
| G | Fan low speed (for air circulation) |
| $Y_1$ | Heat Pump Stage 1 (Compressor) |
| $R_H$ | 24VAC Hot |
| L | Fault (24VAC when fault condition) |
| $W_2$ | Heat Pump Stage 2 (auxiliary heat) / Emergency Heat |
| $O/B/W_1$ | Cooling Mode (reversing valve) |
| $Y_2$ | Not Applicable |
| $AR_1$ | Airflow Reduction* |
| $AR_2$ | Airflow Reduction* |
| I | Plenum Heater dry contact |
| 1 | Plenum Heater dry contact |

* Connect $AR_1$ to $AR_2$ with a dry contact to reduce the airflow by 15%. Refer to the Fan Motor sub-section for more information.

## FAN MOTOR

The unit is equipped with a direct drive ECM fan motor for maximum efficiency. The motor features a soft start which further improves efficiency by eliminating inrush current and provides a smooth, quiet ramp up to speed . The motor will maintain the programmed air flow up to the maximum external static value. Refer to the **APPENDIX A: ECM Fan Airflow Tables.**

The air flow can be set to four different levels by changing the position on the Air Flow board located in the electrical box. The four levels are indicated in **TABLE 2**. The actual air flow values can be found in **APPENDIX A**.

Units are shipped with the **MED** position selected for nominal air flow. The air flow can be further reduced by 15% by making a dry contact across $AR_1$ and $AR_2$ on the terminal strip.

| TABLE 2 - Airflow Selections | |
|---|---|
| **Position** | **Airflow** |
| **LOW** | **-6%** |
| **MED** | **Nominal** |
| **HIGH** | **+6%** |
| **MAX** | **+12%** |

This can be used for applications that have multiple zones, or retrofits with undersized ductwork, to help reduce air flow noise in the ductwork. It is recommended that airflow reduction only be used with the High or Max air flow setting. Care should be taken to ensure that the unit does not trip a safety control in heating or cooling mode if the 15% reduction is used in conjunction with the Med or Low air flow setting.

## CONTROL TRANSFORMER

The low voltage controls for all models are powered by a 100VA transformer with either primary and secondary fuses or a 100VA transformer with a secondary resettable breaker for circuit protection. Should a fuse blow, determine the problem and rectify it before replacing the fuse or resetting the breaker. **NOTE:** For 208/230VAC-1-60 units, if connecting to 208VAC power supply move the red wire connected to the 240 terminal of the transformer to the 208 terminal of the transformer.

## SAFETY CONTROLS

The heat pump has two built in safety controls which are designed to protect the unit from situations which could damage it should the operation of the refrigeration circuit fall outside the allowable operating range.

**A. Low Pressure Control**

The low pressure control monitors the compressor suction pressure and will shut the compressor down if the refrigerant evaporating pressure becomes too low.

There only reason this control would activate in response to the operating conditions of the unit in the heating mode would be due to a ruptured loop, causing a low refrigerant charge. Any other low pressure trips would be due to a fault in the unit.

**B. High Pressure Control**

The high pressure safety control monitors the compressor discharge pressure and will shut the compressor down if the condensing pressure becomes too high.

There are (3) main reasons why this control would activate in response to the operating conditions of the unit while operating in heating mode:

1. Low or no airflow.
2. High return air temperature.
3. Dirty air coil due to poor filter maintenance.

Each of the controls are auto-reset controls. There is also a manual reset high pressure control should the control board be faulty and fail to disengage the compressor. It can be reset by pressing the rubber button on the end of it. It is electrically located between the Y output of the control board and the compressor contactor coil.

The control board (see next section) monitors the pressure controls and shuts the compressor off immediately for a set period of time (adjustable) should there be a fault. The counter for the safety control in question will be increased by 1. The LED indicator for the control will flash until the control is reset as the pressures equalize in the unit. The unit may restart after the timer period has expired. Should the unit trip on the safety control again , the compressor will once again shut down and the counter will be incremented by one again. Each time this occurs the count is incremented until the counter reaches the max value (default is 3) at which point a permanent lockout will occur if this occurred within a set period of time (default 6 hours) and the compressor cannot be started again until the control board is reset by shorting the reset pins together or turning the power off and on again. The lockout count is decreased after a set period of time (default 6 hours) if there are no more occurrences.

If the control board enters permanent lockout mode there is a serious problem with the system and it must be rectified if the unit is to maintain good service.

## DOMESTIC HOT WATER CONNECTIONS (HW & HACW only)

A typical piping diagram for a pre-heat tank configuration can be found in **drawing 000970PDG** at the end of this section. Be sure to note the position of the check valve and the direction of water flow. Other configurations are possible, and there may be multiple units tied together in larger buildings.

**WARNING: USE ONLY COPPER LINES TO CONNECT THE DESUPERHEATER. TEMPERATURES COULD REACH 200F SHOULD THE DHW CUTOUT SWITCH FAIL, POTENTIALLY RUPTURING PEX PIPING.**

Ensure the tank is filled with water and under pressure before activating the heat pump. Slightly loosen the boiler drain on the DHW Out pipe to allow air to escape from the system before the unit is started. This step will make certain that the domestic hot water circulator in the unit is flooded with water when it is started.

***CAUTION: the domestic hot water pump is water lubricated; damage will occur to the pump if it is run dry for even a short period of time.***

Connect the brown wire with the blue insulated terminal to L1 of the compressor contactor. **Ensure the power is off when connecting the wire.**

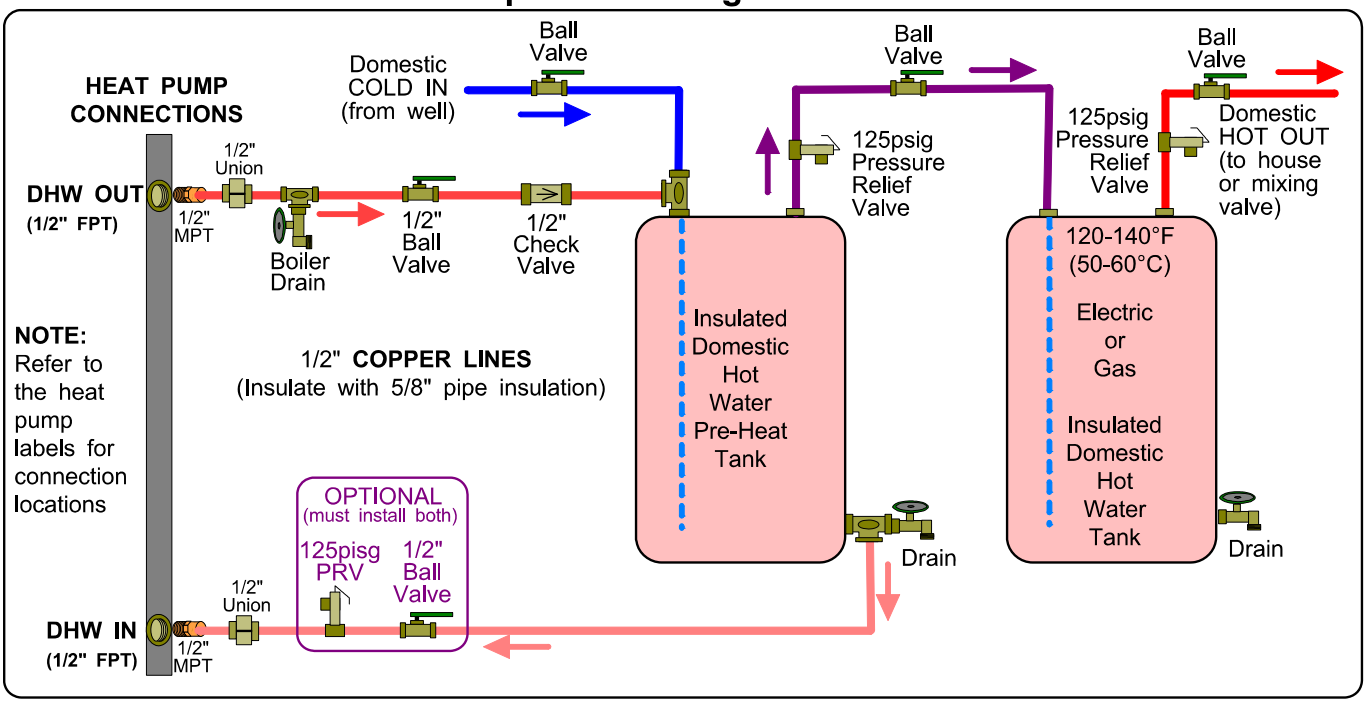
The DHW loop may have to be purged of air several times before good circulation is obtained. A temperature difference between the DHW In and DHW Out can be felt by hand when the circulator pump is operating properly.

For the pre-heat tank setup, the final tank should be set to **140°F(60°C),** unless local code requires a higher setting. The pre-heat tank does not require electric elements. This setup takes full advantage of the desuperheater as it is the sole heat provider to the pre-heat tank. The desuperheater remains active during the compressor runtime until the pre-heat tank has been completely heated by the desuperheater alone. This setup is more energy efficient than a single tank setup.

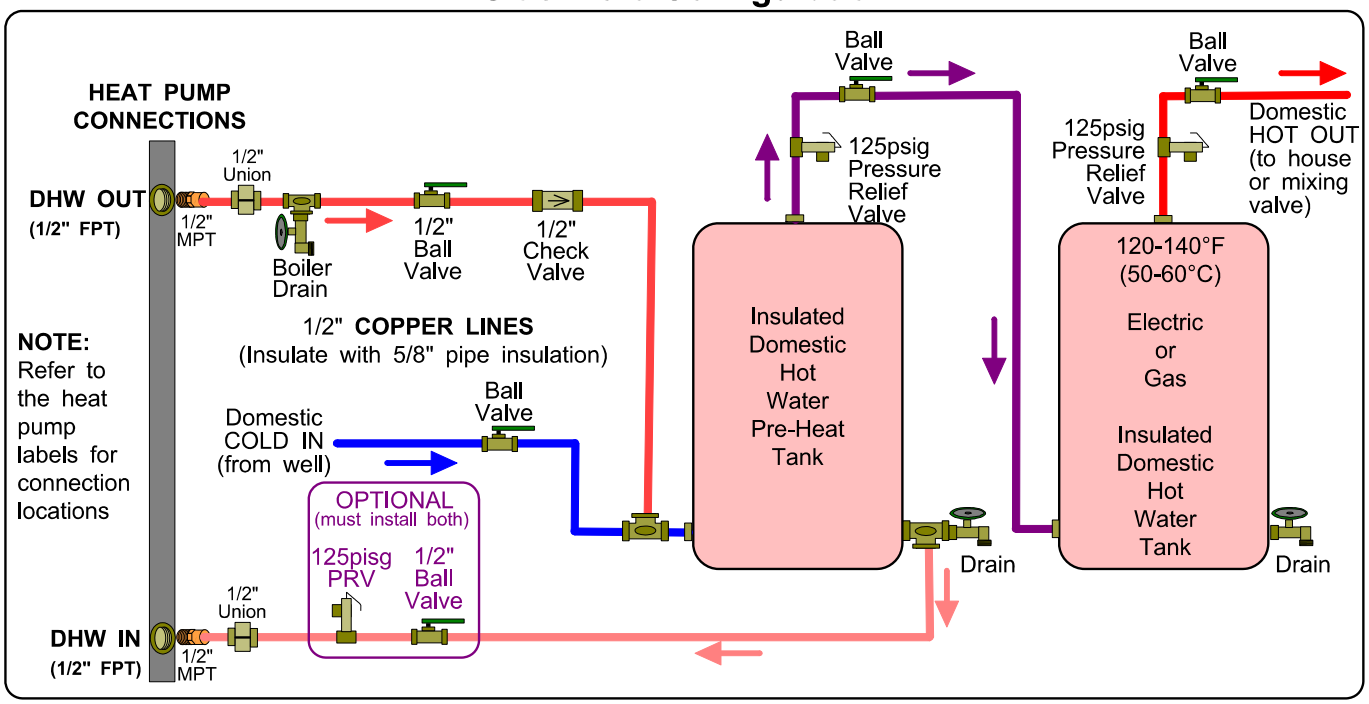
***CAUTION: If two (2) shut-off valves are located on the domestic hot water ines as shown in the diagram, a pressure relief valve must be installed to prevent possible damage to the domestic hot water circulator pump should both valves be closed.***

# Single Unit Connection to Domestic Hot Water Pre-Heat Tank (Brass FPT)

## Top Port Configuration




## Side Port Configuration




| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 01 | Initial Release | C. GEDDES | C. GEDDES | 10 MAR 09 |

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| Drawn By: Chris Geddes | Date: 10 MAR 09 | MARITIME GEOTHERMAL LTD. | 170 Plantation Rd. Petitcodiac, NB E4Z 6H4 |
| Checked By: Chris Geddes | Date: 10 MAR 09 | Drawing Name: Single Unit Connection to DHW Pre-Heat Tank (Brass FPT) | |
| Approved By (ENG): Chris Geddes | Date: 10 MAR 09 | | |
| Approved By (MFG): | Date: | | |
| Approved By: | Date: | | |

| Size | Drawing Number | REV | SHEET |
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# Direct Expansion Unit Operation

## REFRIGERATION

Direct expansion operation is essentially the same as any other heat pump. The main difference is in the outdoor loop section. Direct expansion heat pumps eliminate the intermediate ground loop exchanger and pumping equipment by using copper loops to interact directly with the earth. For each ton of capacity, the evaporator (heating mode) consists of one three-way valve, one heating thermostatic expansion valve (TXV), a pair of check valves and one outdoor copper loop with one vapour and one liquid connection to the heat pump. For each additional ton of capacity, there is a parallel evaporator circuit added to the unit.

In heating mode, all loops are used simultaneously to create a large evaporator. This allows maximum heat transfer from the loop field. Since each loop has it's own TXV, its superheat can be individually tailored, allowing each loop to obtain the same superheat even it may have different soil conditions. The loop select valves default to open in heating mode, and as such none of the loop select valve solenoid coils are energized.

In cooling mode, running all loops at the same time would create far too large a condenser and the unit would have very low head pressure, causing the suction pressure to fall off until the low pressure safety control was reached. To circumvent this problem, the direct expansion unit will begin cooling mode by using only Loop 1.

Loops are selected by activating the solenoid on the loop select valve for the loop in question. The remaining loops are scavenged to the suction line.

Using one loop greatly reduces the size of the condenser, allowing the unit to operate properly. As the ground temperature warms up, rejecting the heat to the ground becomes more difficult, causing the head pressure to increase. When the loop is sufficiently hot enough to reach the **Loop Switch set point (290psig)**, the unit will switch to Loop 2. This starts the cycle over with a new loop and allows the previous loop time to recover. Heat pump operation will continue, switching through the loops as required.

The time between loop changes is monitored and should it fall below the adjustable threshold (default 15 minutes), indicating that the loops are sufficiently hot, the heat pump will begin using two loops at a time, and continue cycling. If the loop switch time falls below the threshold on two loop mode, the soaker hose will be turned on (if installed). The soaker hose cools the loops down with water. The loop sequences are shown in **TABLE 3**.

**TABLE 3 - Cooling Mode Loop Sequences**

| # of Loops | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 2 | 1 & 2 | | | | | |
| 3 | 1 & 2 | 2 & 3 | 1 & 3 | | | |
| 4 | 1 & 2 | 3 & 4 | | | | |
| 5 | 1 & 2 | 3 & 4 | 1 & 5 | 2 & 3 | 1 & 3 | 4 & 5 |

As the transition from summer to fall begins and the cooling load is greatly reduced, the loops begin to cool down on their own. Eventually a point is reached at which the loops are cooled down enough that two loops becomes too large a condenser. This may occur naturally or there may be a few heating days and then a warm spell again (the loops settings are not affected by a switch to heating mode). Two loop operation can no longer be sustained and the unit will trip the low pressure safety control. This occurrence will set the heat pump back to one loop mode and allow the unit to run properly when it automatically restarts after the lockout timer expires.

## CONTROL BOARD

All heating / cooling direct expansion units contain a control board that monitors the thermostat signals, safety controls and loop pressures. It controls the operation of the compressor, fan and auxiliary / emergency heat. It also activates the reversing valve and controls the loop sequencing when in cooling mode. Heating only units do not have a control board.

The number of cooling loops must be configured (done at the factory). There are two jumpers to the top right of the microcontroller. The configuration is shown in **TABLE 4.**

There is also a jumper marked DEFAULT that should be left in place. The jumper marked IF NO B TERMINAL should be left place as well unless the thermostat used has a B terminal that is constantly powered in heating mode.

**TABLE 4 - Cooling Loop Configuration**

| # of Loops | Left Jumper | Right Jumper |
|---|---|---|
| 2 | OFF | OFF |
| 3 | ON | OFF |
| 4 | OFF | ON |
| 5 | ON | ON |

The control board has 4 connectors: one for the thermostat connections; one for the heat pump component connections; one for the loop solenoid connections; and one for the safety control and loop pressure switch connections. There are also several LEDs to indicate the status of the control board. **Refer to drawing 000301CDG** for the location of the connectors and LEDs.

The Heart Beat LED flashes once every second. This indicates that the control board is operational. An on-board COP watchdog timer resets the microprocessor should anything affect code execution.

The high and low pressure control LEDs flash once per second when a control is open. They will stay on if there is a permanent lockout.

The loop switch LED will come on when the loop pressure switch is activated. Note that the loop switch is only for cooling mode, it does not affect heating mode operation.

There is a compressor short-cycle timer (default 2 minutes) and also a mode switch timer (default 5 minutes). Both are adjustable through the control board communications port.

The high pressure, low pressure and loop switch are 5VDC signals. The low pressure control connects to L and L on the control board. The high pressure control connects to H and H. The loop switch connects to S and S. All other inputs and outputs are 24VAC.

When the thermostat calls for heat, the compressor will start (Stage 1), as will the fan after a short delay (adjustable). The unit will run until the thermostat is satisfied and the unit shuts off (the fan will continue to run for an adjustable period); or, a set period of time elapses (default 40 minutes). Should the set period elapse, the auxiliary heat (Stage 2) will be engaged to help the unit on cold days when the load is too large for the unit.

When the thermostat calls for cooling, the compressor will start (Stage 1), as will the fan after a short delay (adjustable). The unit will run until the thermostat is satisfied and the unit shuts off (the fan will continue to run for an adjustable period). During operation, the control board will cycle through the loops as required.

The control board has an RS-232 communications port on board. A simple program such as Hyper Terminal and an adapter cable can be used to communicate with the control board. **Drawing 000301CDG** shows how to build the communications cable. The port settings are shown in **TABLE 5**. The commands available are listed in **TABLE 6**. Note that the COP must be unlocked by command U before using command C to change system settings. The list of settings for command C is shown in **TABLE 7**. It is recommended that the settings be left at the defaults values.

**TABLE 5 - RS232 Port Configuration**

| Item | Setting |
|---|---|
| Baud | 9600 |
| Data Bits | 8 |
| Parity | None |
| Stop Bits | 1 |
| Flow Control | Xon / Xoff |

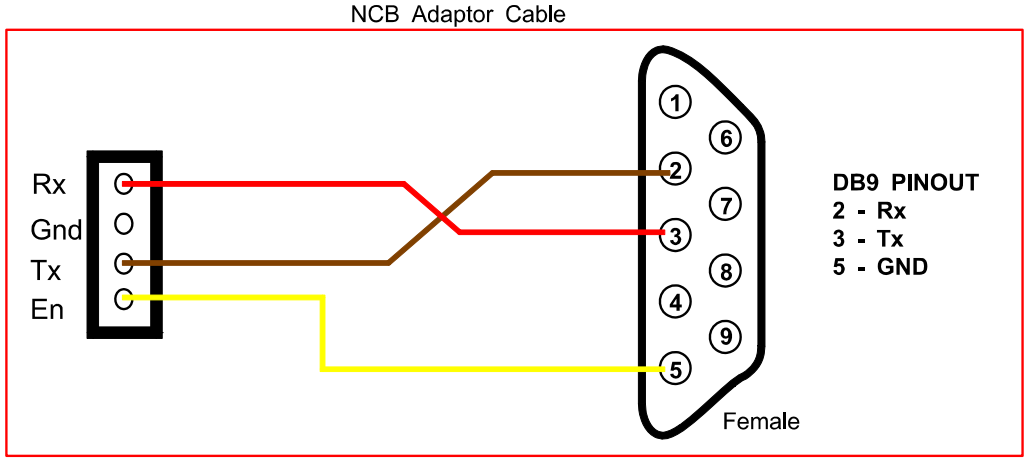
**TABLE 6 - Control Board Commands**

| Command | Description |
|---|---|
| H | Help - displays the list of commands |
| U | Lock / unlock the COP watchdog |
| L | Display loop status |
| M | Display loop history |
| S | Display system status |
| D | Display system configuration |
| C | Change system settings (use U first) |
| T | System runtimes |
| ! | Advance system time by 59 minutes |
| Z | Reset loop timers to zero |

**TABLE 7 - Control Board Default Settings**

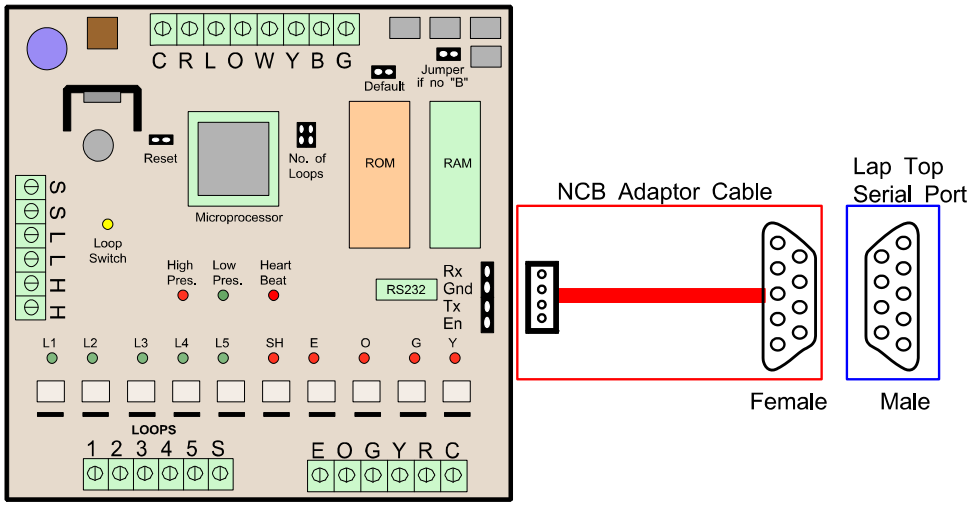
| Command | Air Unit |
|---|---|
| Blower wait time after comp. start | 2sec |
| Blower run time after comp. stops | 5sec |
| Blower run time after aux. heat off | 59sec |
| Aux. heat on time after comp. on | 40min |
| Comp. off if low lockout (HEAT) | 5min |
| Comp. off if low lockout (COOL) | 30min |
| Comp. off if high lockout (HEAT) | 5min |
| Comp. off if high lockout (COOL) | 30min |
| Comp. off time between heat & cool | 5min |
| Comp. delay since being off | 2min |
| Min. loop time before mode increase | 15min |
| Loop pressure testing wait time | 7sec |
| Soaker start after comp. on time | 2hrs |
| Soaker hose run time (maintenance) | 4hrs |
| Soaker hose run time (emergency) | 12hrs |
| System check interval | 2sec |
| Low pres. lockout counter reduce time | 6hrs |
| High pres. lockout counter reduce time | 6hrs |
| Low pres. lock ignore counter | 3 times |
| High pres. lock ignore counter | 3 times |
| Reset mode = 1 and loop memory time | 2 weeks |
| Maximum mode to be allowed | 2 |
| Ignore low pres. for | 5min |
| Ignore low pres. for | 0sec |

# NCB Lap Top Communication Cable




Take a 9-pin serial cable and cut the male end off. A 0.100" spacing 4 pin header can be obtained from a floppy drive power cable in an old computer. Connect the wires as shown in the diagram above. A multimeter set to continuity may be used to find the correct wires fron the 9-pin cable. A small paper clip will fit in the 9-pin connector holes.

Hyperterminal can be used to communicate with the control board. The com ports settings are 9600 baud, 8 data bits, no parity, 1 stop bit, Xon/Xoff control. The board echos commands so echo is not required in hyperterminal. Once connected, press H to display the available commands for the control board.




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Drawn By Chris Geddes | Date 19 OCT 06 | MARITIME GEOTHERMAL LTD. | 170 Plantation Rd. Petitcodiac, NB E4Z 6H4 |
| | | | | | Checked By Chris Geddes | Date 19 OCT 06 | | |
| | | | | | Approved By (ENG) Chris Geddes | Date 19 OCT 06 | Drawing Name NCB Lap Top Communication Cable | |
| | | | | | Approved By (MFG) | Date | | |
| 01 | Initial Release | C. GEDDES | C. GEDDES | 19 OCT 06 | Approved By | Date | Size A | Drawing Number 000301CDG |
| REV | ECO # | IMPL BY | APVD BY | DATE | | | | REV 01 |
| | | | | | | | | SHEET 1 of 1 |

## HEAT PUMP SIZING

**TABLE 8** depicts a rough guideline as to the size of home each heat pump size can handle direct expansion installations.

**TABLE 8 - Heat Pump Size vs. Heated Area**

| Model | Size (tons) | Sq.ft. | Sq.m. |
|---|---|---|---|
| 25 | 2 | 800 | 75 |
| 45 | 3 | 1,400 | 130 |
| 55 | 4 | 2,000 | 185 |
| 65 | 5 | 2,600 | 240 |

**THE TABLE ABOVE IS FOR INFORMATION ONLY, IT SHOULD NOT BE USED TO SELECT A UNIT SIZE.** It simply shows on average what size unit is required for a typical two-level home (main level and below grade basement) with R-20 walls, R-40 ceiling and average size and number of windows. The Heated Area is the area of the main level, The tables account for a basement the same size as the heated area.

**MARITME GEOTHERMAL LTD. HIGHLY RECOMMENDS THAT A PROPER HEAT LOSS/GAIN ANALYSIS BE PERFORMEDE BY A PROFESSIONAL INSTALLER WITH CSA APPROVED SOFTWARE BEFORE SELECTING THE SIZE OF UNIT REQUIRED FOR THE APPLICATION. For heating dominant areas, we recommend sizing the unit to 100% of the heating design load for maximum long term efficiency with minimal supplementary heat. The unit should be installed as per CSA 448.2-02.**

There are many factors to consider when sizing the heat pump. Some of these factors include the number of levels, the size of the windows, the orientation of the home, attached garage, bonus rooms, walk-in basement, coldest outdoor temperature, etc. The heat loss program will take all of these factors into consideration in its calculations. An undersized installation will not be as efficient and will require expensive supplementary heat to maintain a comfortable temperature in the home, and the cost savings of having a geothermal heat pump are greatly reduced.

Once the total heat loss has been calculated, the unit can be sized using the performance tables (from the specifications document) in conjunction with the minimum expected entering liquid temperature of the ground loop (well water temperature for ground water system). The heat pump output must be able to match the total heat loss at the selected entering water temperature in order to provide a comfortable environment with minimal auxiliary heat.

## DUCT SYSTEMS - GENERAL

Ductwork layout for a heat pump will differ from traditional hot air furnace design in the number of leads and size of main trunks required. Air temperature leaving the heat pump is normally **95º -105ºF (35-40ºC),** much cooler than that of a conventional warm air furnace. To compensate for this, larger volumes of lower temperature air must be moved and consequently duct sizing must be able to accommodate the greater air flow without creating a high static pressure or high velocity at the floor diffusers.

A duct system capable of supplying the required air flow is of utmost importance. Maritime Geothermal Ltd. recommends that the static pressure be kept below 0.2 inches of water total. In some instances the number of floor diffusers will actually double when compared to the number that would be used for a hot air oil-fired furnace. Refer to **TABLE 11** at the end of this section.

1. Generally allow **100 cfm** for each floor grill.
2. All leads to the grills should be 6" in diameter (28sq.in. each).
3. The main hot air trunks should be at least 75% of the square surface area of leads being fed at any given point.
4. Return air grills should have a minimum of the same total square surface area as the total of the supply grills.
5. The square surface area of the return trunks should equal the square surface area of the grills being handled at any given point along the trunk.

It is ***VERY IMPORTANT*** that all turns in both the supply trunks and the return trunks be made with ***TURNING RADII***. Air act like a fluid and, just like water, pressure drop is increased when air is forced to change direction rapidly around a sharp or irregular corner.

It is recommended that flexible collars be used to connect the main trunks to the heat pump. This helps prevent any vibrations from travelling down the ductwork. If a plenum heater is installed, the collar should be at least 12” away from the heater elements.

The first 5-10 feet of the main supply trunks should be insulated with acoustical duct insulation to further inhibit any noise from the unit from travelling down the ductwork. If a plenum heater is installed, insulation should not be placed within 12” of the heater elements.

**Drawing 000606CDG** shows a typical installation.

## DUCT SYSTEMS - GRILL LAYOUT

Most forced air heating systems in homes have the floor grills placed around the perimeter of the room to be heated. Supply grills should be placed under a window when possible to help prevent condensation on the window. As mentioned in the previous sub-section, supply grill leads should be 6" in diameter (28 sq.in. each) to allow **100cfm** of air flow.

In a typical new construction, there should be one supply grill for every 100sq.ft. of area in the room. When rooms require more than one grill, they should be placed in a manner that promotes even heat distribution, such as one at each end of the room. It is always a good idea to place a damper in each grill supply or place adjustable grills so that any imbalances in the heat distribution can be corrected.

The total number of supply grills available is based on the heat pump nominal airflow. **TABLE 9** shows the number of grills available per heat pump size.

**TABLE 9 - Heat Pump Size vs. Hot Air Grills**

| Model | Size (tons) | # of Grills (@100cfm) |
|---|---|---|
| 25 | 2 | 8 |
| 45 | 3 | 12 |
| 55 | 4 | 15 |
| 65 | 5 | 19 |

Return grills should be mounted on the floor. At minimum they should be the same size as the supply grill, **it is highly recommended that they be 25% to 50% larger than the total supply.** They should be placed opposite the supply grills when possible to ensure distribution across the room. For rooms requiring more than one supply grill, it may be possible to use one larger return grill if it can be centrally positioned opposite of the supply grills, however it is preferred to have one return for each supply to maximize heat distribution across the room.

## THERMOSTAT LOCATION

Most homes are a single zone with one thermostat. The thermostat should be centrally located within the home, typically on the main floor. It should be placed away from any supply grills, and should not be positioned directly above a return grill. Most installations have the thermostat located in a hallway, or in the inner wall of the living room. It should be noted that most homes do not have any supply ducts in the hallway. This can lead to a temperature lag at the thermostat if there is very little air movement in the hallway, causing the home to be warmer than indicated by the thermostat.

## PLENUM HEATER (OPTIONAL)

For installations that do not already have a backup heat source such as electric baseboard, wood stove, propane etc, it is recommended that a plenum heater be installed. This provides two functions.

The first function of the plenum heater is to act as an auxiliary heat source. As such it will provide additional heat on extremely cold days if the heat pump is unable to bring the home temperature up quickly enough, eliminating any discomfort to the homeowner.

The second function of the plenum heater is to provide emergency heat should a problem occur that causes the heat pump to be locked out. This can be engaged by setting the thermostat to emergency heat, allowing the plenum heater to function while preventing the heat pump from operating. Should the heat pump fail while the home is vacant, the auxiliary function of the thermostat will maintain the temperature setting of the thermostat.

The plenum heater is powered separately from the heat pump. Only two control wires are needed to connect the plenum heater to the heat pump. Refer to the label on the plenum heater or the electrical box diagram on the inside of the electrical box cover of the unit for details on the connections.

The plenum heater should be mounted in the supply duct in a manner that allows all of the airflow to pass through it to prevent any hot spots in the heater elements.

**TABLE 10** shows the recommended size plenum heater, as well as the wire size and breaker size needed to provide power to the plenum heater.

**TABLE 10 - Plenum Heater Sizing**

| Heat Pump | | Plenum Heater (230-1-60) | | | |
|---|---|---|---|---|---|
| Model | Size (Tons) | Size (kW) | Current (A) | Breaker (A) | Wire Size |
| 25 | 2 | 5 | 21 | 40 | #10 |
| 45 | 3 | 10 | 42 | 60 | #6 |
| 55 | 4 | 15 | 62 | 100 | #3 |
| 65 | 5 | 20 | 84 | 125 | #3 |

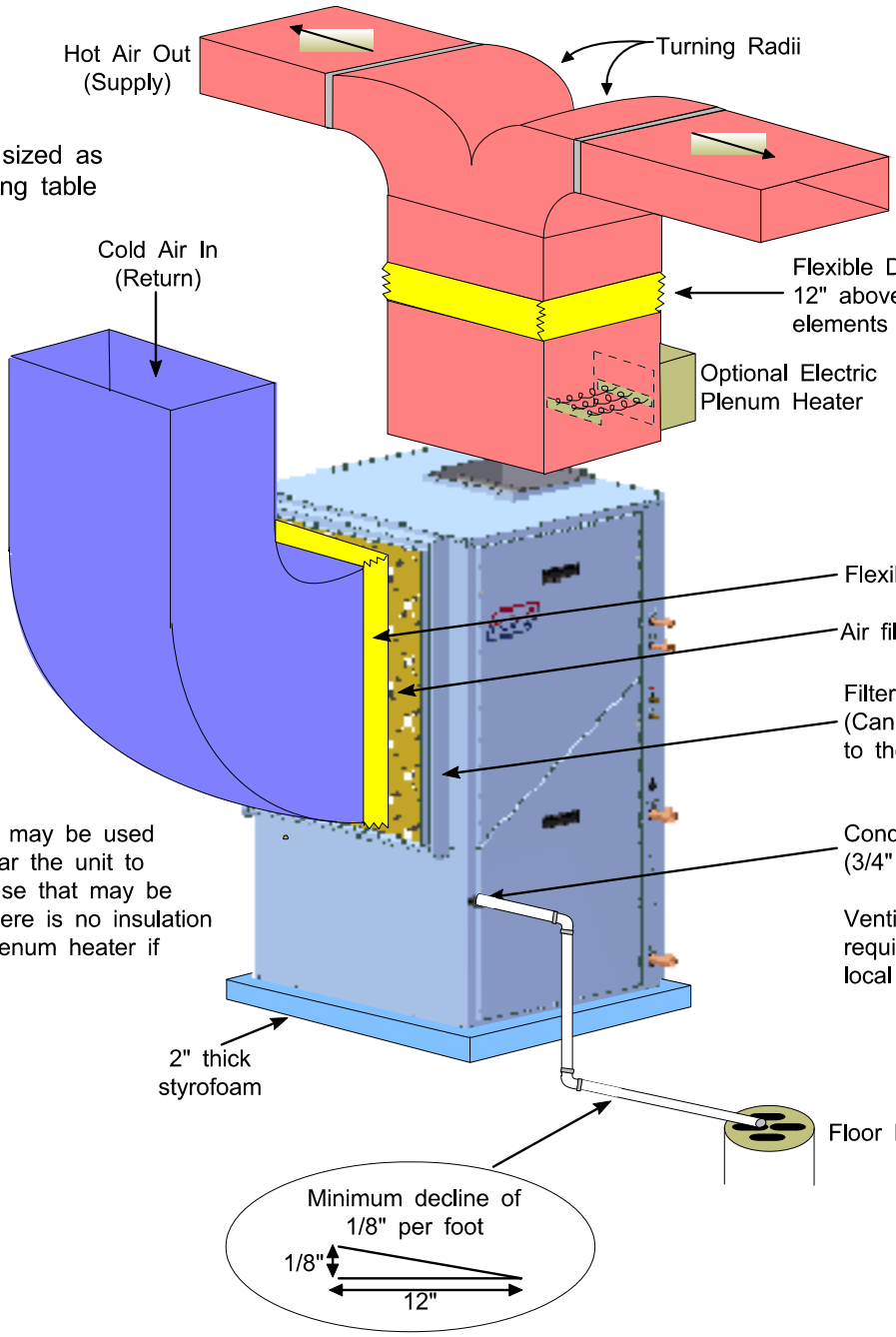
## CONDENSATE DRAIN

The unit comes equipped with a 3/4" PVC socket fitting (female) labeled "Condensate Drain". This drain allows the condensate which forms during the air-conditioning cycle to be removed from the unit. The drain should be connected as per local codes. During high humidity weather, there could be as much as 25 gallons of water formed per day.

Care should be taken in the spring to ensure that this pipe is not plugged with dust that has collected during the winter causing the condensate to overflow into the bottom of the heat pump and onto the floor. **The condensate drain is internally trapped; however, proper venting is required external to the heat pump. Refer to local codes to ensure the installation is done properly.**

**Drawing 000606CDG** shows a typical installation.

# Typical Duct and Condensate Connections (Vertical Case)




Ducts should be sized as per the Duct Sizing table in this manual

Accoustic insulation may be used inside the ducts near the unit to dampen any air noise that may be present. Ensure there is no insulation within 12" of the plenum heater if installed.

| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 01 | Initial Release | C. GEDDES | C. GEDDES | 15 JAN 08 |

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| Drawn By: Chris Geddes | Date: 15 JAN 08 | |
| Checked By: Chris Geddes | Date: 15 JAN 08 | |
| Approved By (ENG): Chris Geddes | Date: 15 JAN 08 | |
| Approved By (MFG): | Date: | |
| Approved By: | Date: | |

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170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: Typical Duct and Condensate Connections (Vertical Case)

| Size | Drawing Number | REV | SHEET |
|---|---|---|---|
| A | 000606CDG | 01 | 1 of 1 |

# TABLE 11 - Duct Sizing Guide (external static of 0.20”H2O)

| Airflow (CFM) | Minimum Duct Area (sq.in) | Diameter (in) | Rectangular Equivalents (in) | | | | | | Return Air Diameter (in) | Airflow (L/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 20 | 5 | 2.25 x 10 | 3 x 8 | 3.5 x 6 | 4 x 5.5 | 5 x 5 | | 5 | 17 |
| 63 | 20 | 5 | 2.25 x 10 | 3 x 8 | 3.5 x 6 | 4 x 5.5 | 5 x 5 | | 6 | 30 |
| 100 | 28 | 6 | 3.25 x 10 | 4 x 8 | 5 x 6 | 5.5 x 5.5 | 6 x 6 | | 7 | 47 |
| 152 | 38 | 7 | 3.25 x 14 | 4 x 11 | 5 x 8.5 | 6 x 7 | 6.5 x 6.5 | | 8 | 72 |
| 212 | 50 | 8 | 4 x 15 | 5 x 12 | 6 x 10 | 7 x 8 | 8 x 8 | | 9 | 100 |
| 226 | 50 | 8 | 4 x 15 | 5 x 12 | 6 x 10 | 7 x 8 | 8 x 8 | | 10 | 107 |
| 277 | 64 | 9 | 5 x 15 | 6 x 12 | 7 x 10 | 8 x 9 | 8.5 x 8.5 | | 10 | 131 |
| 304 | 64 | 9 | 5 x 15 | 6 x 12 | 7 x 10 | 8 x 9 | 8.5 x 8.5 | | 12 | 143 |
| 393 | 79 | 10 | 6 x 15 | 7 x 13 | 8 x 11 | 9 x 10 | 9.5 x 9.5 | | 12 | 185 |
| 411 | 113 | 12 | 7 x 18 | 8 x 16 | 9 x 14 | 10 x 12 | 11 x 11 | | 12 | 194 |
| 655 | 113 | 12 | 7 x 18 | 8 x 16 | 9 x 14 | 10 x 12 | 11 x 11 | | 14 | 309 |
| 680 | 154 | 14 | 8 x 22 | 9 x 19 | 10 x 17 | 11 x 15 | 12 x 14 | 13 x 13 | 14 | 321 |
| 995 | 154 | 14 | 8 x 22 | 9 x 19 | 10 x 17 | 11 x 15 | 12 x 14 | 13 x 13 | 16 | 470 |
| 1325 | 201 | 16 | 8 x 30 | 10 x 22 | 12 x 18 | 14 x 16 | 15 x 15 | | 18 | 625 |
| 1450 | 201 | 16 | 8 x 30 | 10 x 22 | 12 x 18 | 14 x 16 | 15 x 15 | | 20 | 684 |
| 1750 | 254 | 18 | 8 x 40 | 10 x 30 | 12 x 24 | 14 x 20 | 16 x 17 | 16.5 x 16.5 | 20 | 826 |
| 2000 | 254 | 18 | 8 x 40 | 10 x 30 | 12 x 24 | 14 x 20 | 16 x 17 | 16.5 x 16.5 | 22 | 944 |
| 2250 | 314 | 20 | 10 x 38 | 12 x 30 | 14 x 26 | 16 x 22 | 18 x 19 | 18.5 x 18.5 | 22 | 1062 |
| 2600 | 314 | 20 | 10 x 38 | 12 x 30 | 14 x 26 | 16 x 22 | 18 x 19 | 18.5 x 18.5 | 24 | 1227 |
| 2900 | 380 | 22 | 12 x 36 | 14 x 30 | 16 x 26 | 18 x 23 | 20 x 20 | | 24 | 1369 |
| 3400 | 380 | 22 | 12 x 36 | 14 x 30 | 16 x 26 | 18 x 23 | 20 x 20 | | 26 | 1605 |
| 3600 | 452 | 24 | 14 x 38 | 16 x 32 | 18 x 28 | 20 x 25 | 22 x 22 | | 26 | 1699 |
| 4300 | 452 | 24 | 14 x 38 | 16 x 32 | 18 x 28 | 20 x 25 | 22 x 22 | | 28 | 2029 |
| 5250 | 531 | 26 | 16 x 38 | 18 x 32 | 20 x 30 | 22 x 24 | 24 x 24 | | 30 | 2478 |
| 6125 | 616 | 28 | 18 x 38 | 20 x 34 | 22 x 30 | 24 x 28 | 26 x 26 | | 32 | 2891 |
| 6500 | 616 | 28 | 18 x 38 | 20 x 34 | 22 x 30 | 24 x 28 | 26 x 26 | | 34 | 3068 |
| 7250 | 707 | 30 | 20 x 40 | 22 x 38 | 24 x 32 | 26 x 30 | 28 x 28 | | 34 | 3422 |
| 7800 | 707 | 30 | 20 x 40 | 22 x 38 | 24 x 32 | 26 x 30 | 28 x 28 | | 36 | 3681 |
| 8500 | 804 | 32 | 22 x 40 | 24 x 38 | 26 x 34 | 28 x 32 | 30 x 30 | | 36 | 4012 |
| 9200 | 804 | 32 | 22 x 40 | 24 x 38 | 26 x 34 | 28 x 32 | 30 x 30 | | 38 | 4342 |
| 9800 | 908 | 34 | 24 x 42 | 25 x 40 | 26 x 38 | 28 x 34 | 30 x 32 | 31 x 31 | 38 | 4625 |
| 10900 | 908 | 34 | 24 x 42 | 25 x 40 | 26 x 38 | 28 x 34 | 30 x 32 | 31 x 31 | 40 | 5144 |
| | | | 28 x 40 | 30 x 36 | 32 x 34 | 33 x 33 | | | | |
| | | | 30 x 42 | 32 x 38 | 34 x 36 | 35 x 35 | | | | |
| | | | 30 x 45 | 34 x 40 | 36 x 38 | 37 x 37 | | | | |

# Direct Expansion Loop Connection & Charging

## LINE SET INTERCONNECT TUBING

Once the outside loops have been installed and run into the building, the piping to the ports on the unit can be constructed. Each line set has a liquid line and a vapour line. The vapour line is 1/2" (OD) and the liquid line is 3/8" (OD). For horizontal loops, both lines are 1/2" (OD), reduce one of the lines in each line set down to 3/8" (OD) before running the lines over to the heat pump. These reduced lines will be the liquid line for each line set.

Do a final pressure check on each line set and then remove the pressure and cut the ends off the lines. The heat pump has ports labeled Liquid 1 to 5 and Vapour 1 to 5. Run each line set over to the designated ports on the heat pump. Refer to **Diagram 001638CDG** for more information on how to connect to the heat pump.

The tubing used for this procedure must be refrigeration tubing (cleaned & dehydrated) suitable for the job. Every effort must also be made to insure that the tubing does not become contaminated during installation. We recommend that caps be placed on the open ends of tubing immediately after cuts are made and that these caps are only removed after all bends have been made and the pipe fixed in its permanent location ready to make the silver soldered joints. It is very important to keep a refrigeration system perfectly clean and dry. Removing the caps just prior to silver soldering will ensure minimum exposure to the humidity in the atmosphere.

## PIPE INSULATION

All line set piping inside the structure (between the structure entry point and the heat pump) should be insulated with 3/8" thick closed cell pipe insulation to prevent condensation and dripping onto floors or walls during the heating season. It can be slid onto the capped tubing without having to slice it down the side. Ensure that any joints in in the line sets are accessible for leak testing.

Liquid and Vapour ports and any remaining exposed tubing should be insulated with 3/8" thick closed cell pipe insulation once the silver soldering and pressure testing is complete. Ensure that all individual pieces of pipe insulation are glued to each other so there are no air gaps.

## SILVER SOLDERING LINE SETS

Once all the line sets have been routed, insulated and fastened in place, the connections to the heat pump ports can be made. Remove the pressure from the heat pump and cut the ends off of the Liquid and Vapour ports. Remove the caps from the line set tubing. The line sets can be connected to the ports on the heat pump using couplings, or alternately the tubing can be "swaged". The joints should be silver soldered with 5% silfos.

**Maritime Geothermal Ltd. absolutely requires that dry nitrogen be bled through the system during all silver soldering procedures so that no oxidation occurs on the inside of the copper tubing.** The service ports on the unit can be used to connect the nitrogen with a refrigeration manifold.

If necessary, a wet rag can be wrapped around the each of the ports to prevent melting the grommet when silver soldering. Ensure that no water enters any of the ports or tubing.

## PRESSURE TESTING

Once all connections are complete, the system should be pressure tested to **100PSIG (690kPa)** with dry nitrogen. Check all joints at the unit and any made in the interconnect tubing for leaks using soap suds, Spray nine, etc. It is important not to bypass this step as vacuuming the system with a leak will be impossible and attempting to do so will introduce moisture into the system, making the vacuum process take much longer than if the leak had been found and repaired first.

## VACUUMING THE SYSTEM

Remove the pressure from the system and connect the vacuum pump to the refrigeration manifold. Tighten all hose connections, open the valves on the manifold and start the vacuum pump.

Vacuum the system until the reading on an electronic vacuum gauge remains below 500 microns for a period of 5 minutes after the vacuum pump is shut off and the system sealed.

## CHARGING THE SYSTEM

Once the system has been vacuumed, refrigerant can be added by weighing in 1/3 of the prescribed refrigerant charge into the low side of the system. Start the heat pump in the heating mode and continue to add refrigerant as a liquid at a rate of no more than 1 lb. per minute until the prescribed charge is reached.

Alternately, before the machine is started, the entire charge can be weighed into the system through the high side of the system. **TABLE 12** shows the typical charge per unit size. This allows for:

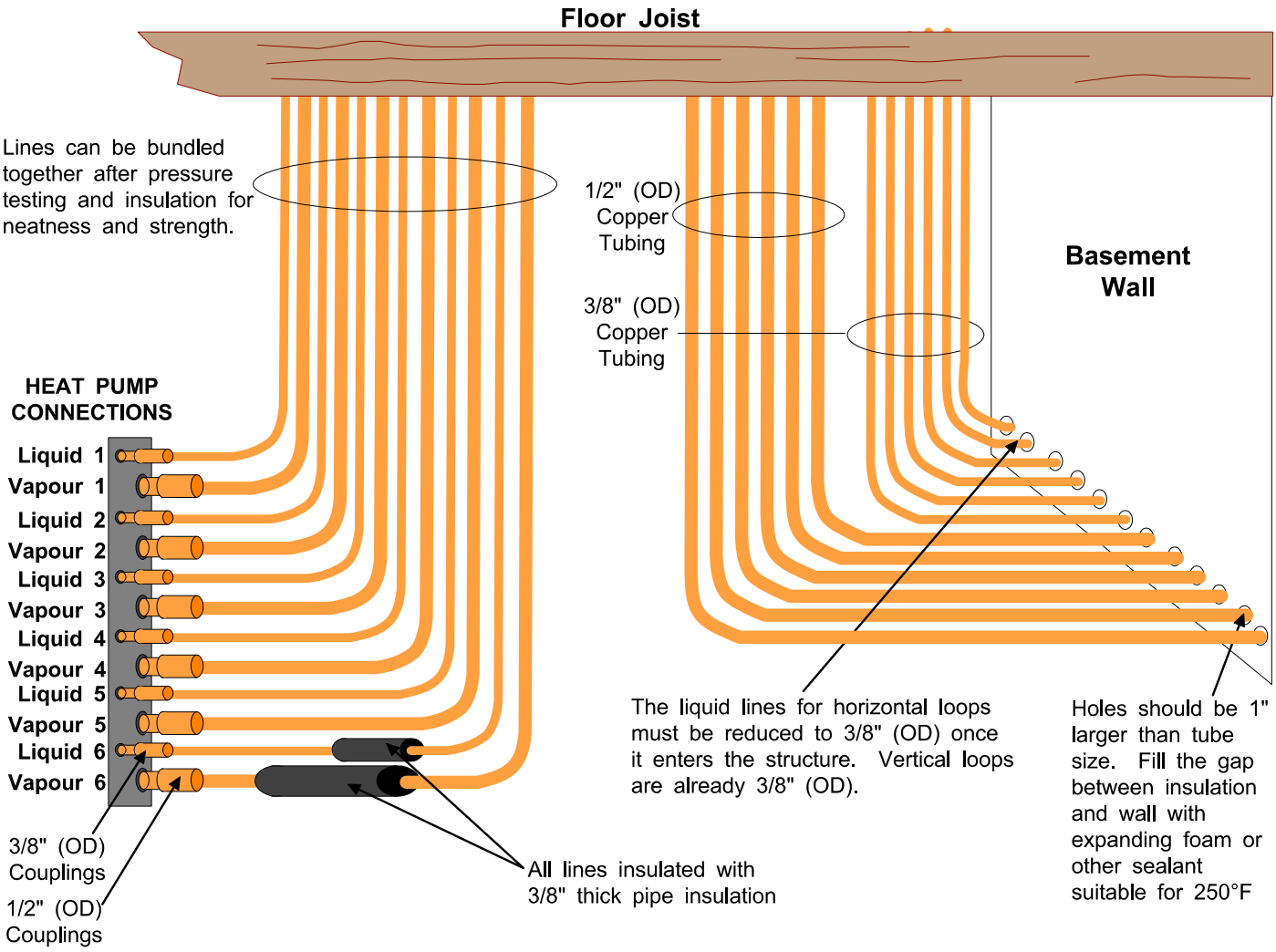
- 20ft of distance (40ft of pipe) interconnect tubing from the unit to the wall,
- 20ft of distance from the wall to the borehole /trench,
- a standard loop (100ft borehole or 150ft trench).

Additional refrigerant is required as per **TABLE 12** if the installation exceeds these parameters.

**TABLE 12 - DX Charge Chart**

| Model | Size (tons) | Lbs. | kg |
|---|---|---|---|
| 25 | 2 | 8 | 3.6 |
| 45 | 3 | 12 | 5.4 |
| 55 | 4 | 16 | 7.3 |
| 65 | 5 | 20 | 9.1 |
| | | | |
| Extra loop (borehole) | | 1 | 0.5 |
| Extra loop (trench) | | 1.5 | 0.7 |
| Extra distance to borehole<br>Extra depth of borehole<br>Extra distance to trench<br>Extra length of trench<br>Extra distance in structure | | 0.1oz per foot | 0.003 |

# DX Line Set Interconnect Tubing Installation (Modular Design-R410a)


Floor Joist
Lines can be bundled together after pressure testing and insulation for neatness and strength.
1/2" (OD) Copper Tubing
3/8" (OD) Copper Tubing
Basement Wall
HEAT PUMP CONNECTIONS
Liquid 1
Vapour 1
Liquid 2
Vapour 2
Liquid 3
Vapour 3
Liquid 4
Vapour 4
Liquid 5
Vapour 5
Liquid 6
Vapour 6
The liquid lines for horizontal loops must be reduced to 3/8" (OD) once it enters the structure. Vertical loops are already 3/8" (OD).
Holes should be 1" larger than tube size. Fill the gap between insulation and wall with expanding foam or other sealant suitable for 250°F
3/8" (OD) Couplings
1/2" (OD) Couplings
All lines insulated with 3/8" thick pipe insulation

**NOTES:**

- Ensure the line sets are kept in order and routed to the proper ports on the heat pump.
- Holes through the foundation / structure should be filled with expanding foam from both sides to prevent leakage.
- Proper drainage material should be used on the outside of the wall to prevent water buildup.
- All joints should be soldered with 5% silver solder.
- Pressure test to 100PSIG and check for leaks once all connections are complete.
- All lines inside the structure and through the wall should be insualted with 3/8" to 1/2" thick closed cell pipe insulation.
- Ensure adjoining pipe insulation pieces are glued or tapes together to prevent gaps.
- Tubing should be securely fastened to prevent accidental bending.

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|---|---|---|---|---|
| 01 | 000196 IR | C. GEDDES | C. GEDDES | 09 APR 12 |

| | | |
|---|---|---|
| Drawn By: Chris Geddes | Date: 13 JUN 12 | |
| Checked By: Chris Geddes | Date: 13 JUN 12 | |
| Approved By (ENG): Chris Geddes | Date: 13 JUN 12 | |
| Approved By (MFG): | Date: | |
| Approved By: | Date: | |

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: DX Line Set Interconnect Tubing Installation (Modular Design-R410a)

| Size | Drawing Number | REV | SHEET |
|---|---|---|---|
| A | 001638PDG | 01 | 1 of 1 |

# Startup Procedure

**The following steps describe how to perform the startup procedure of the geothermal heat pump.**

The DX-Series Two-Stage R410a Startup Record located in this manual is used in conjunction with this startup procedure to provide a detailed record of the installation. A completed copy should be left on site, a copy kept on file by the installer and a copy should be sent to Maritime Geothermal Ltd.

Check the boxes or fill in the data as each step is completed. For data boxes, circle the appropriate units. Fill in the top section of all three copies, or one copy if photocopies can be made after the startup has been completed.

## PRE-START INSPECTION

**Ductwork:**

1. Verify that all ductwork has been completed and is firmly attached to the unit. Verify that any dampers or diverters are properly set for operation of the heat pump.
2. Verify that all registers are open and clear of any objects that would restrict the airflow.
3. Verify that a new air filter is installed and the cover is secured.
4. Verify the condensate drain is connected, properly vented and free of debris.
5. If a plenum heater has been installed, verify that it is securely fastened to the ductwork.

**Line Sets (Inside structure):**

1. Verify that all line sets are connected to the proper ports on the heat pump.
2. Verify that the line sets are completely insulated and securely fastened in place.

**Domestic Hot Water (if equipped):**

1. Verify that all shutoff valves are fully open and there are no restrictions in the piping from the heat pump to the domestic hot water tank.
2. Verify that the entire system has been flooded and all the air has been purged as much as possible. Further purging may be required after the system has been operating for a while.
3. Verify that the brown wire with the insulated terminal is disconnected in the electrical box. Refer to the schematic diagram for more information.

**Electrical:**

1. **Ensure the power to the unit is off. Ensure the power to the plenum heater is off if equipped.**
2. Verify all high voltage connections. Ensure that there are no stray wire strands, all connections are tight and the ground wire is connected tightly to the ground connector for the heat pump and plenum heater.
3. Record the fuse / circuit breaker size and wire gauge for the heat pump. Record the fuse / circuit breaker size, wire gauge and size of the plenum heater if installed.
4. Verify that the control connections to the thermostat and plenum heater (if installed) are properly connected and all control signals are off, so that the unit will not start up when the power is turned on.
5. Ensure all access panels except the lower one that provides access to the electrical box are in place.

**Unit Charge:**

1. Ensure the unit has been vacuumed and has refrigerant in it. If the unit is not fully charged, the remainder can be added during the start up procedure. Record the current amount of refrigerant in the system.

# UNIT STARTUP

The unit is now ready to be started. The steps below outline the procedure for starting the unit and verifying proper operation of the unit. **It is recommended that safety glasses be worn during the following procedures.**

**Preparation:**

**ENSURE UNIT IS CHARGED WITH REFRIGERANT BEFORE TURNING THE POWER ON. STARTING A COMPRESSOR UNDER VACUUM WILL DESTROY IT IN A MATTER OF SECONDS, VOIDING THE WARRANTY. IF THE UNITIS NOT FULLY CHARGED, THE REMAINDER CAN BE ADDED DURING HEATING MODE STEP 2.**

1. Remove the caps from the service ports and connect a refrigeration manifold set to the unit.
2. Turn the power on to the heat pump and set the thermostat to OFF. Set up the thermostat as per the instructions provided with it so that it will function properly with the heat pump system (set for heat pump, not for heating and cooling). The O signal should be set to active in cooling mode.
3. Measure the following voltages on the compressor contactor and record them on the startup sheet: L1-L2, L2-L3, L1-L3.

**Heating Mode:**

1. Set the thermostat to heating mode and adjust the setpoint to activate Stage 1. The fan should slowly ramp up to speed after the time delay of the thermostat expires (if applicable) and the compressor will start.
2. Check the refrigeration gauges. The suction and discharge pressures will depend on the loop temperatures, but they should be about **75-95PSIG** and **290-365PSIG** respectively for a typical start-up. If the unit was not completely charged, add the remaining refrigerant through the suction side only.
3. Monitoring the refrigeration gauges while the unit runs. Record the following data at the time interval(s) indicated: Numbers 1 to 4, record at 10, 15, 20, 25, 30 and then average the values. Record numbers 5 to 8 at 30 minutes. The average superheat for each line set should be **8-14°F (4-8°C).** The TXV's are set to four turns in (from all the way out) at the factory and typically should not require any adjustments. Should adjustment be required, follow the Heating TXV Adjustment procedure in this manual. Proceed to Step 4 once adjustments have been completed.
    1. Suction pressure
    2. Discharge pressure
    3. Each loop Vapour Line temperature
    4. Each loop superheat (Vapour line temperature - evaporating temperature (from suction gauge)
    5. Duct Return temperature (poke a small hole in the flex collar and insert probe in airstream)
    6. Duct Supply temperature (poke a small hole in the flex collar and insert probe in airstream)
    7. Duct Delta T (should be between **22-32°F, 12-18°C**)
    8. Compressor L1(C) current (black wire, place meter between electrical box and compressor)
4. Adjust the thermostat setpoint to the desired room temperature and let the unit run through a cycle. Record the setpoint and the discharge pressure when the unit shuts off.
5. For units with a desuperheater, turn the power off to the unit. Connect the brown wire with the blue insulated terminal to the compressor contactor as shown in the electrical box diagram. Turn the power to the unit on.
6. Verify the DHW IN and DHW OUT temperatures (if applicable) by hand **(caution: pipes get hot).** If the DHW OUT line does not become hotter than the DHW IN line the circulator is air locked. Bleed the air from the system and check the temperature differential again to ensure there is flow from the circulator.
7. Remove the electrical cover from the plenum heater. Place a current clamp meter around one of the supply wires. Turn on the power to the plenum heater. Adjust the thermostat setpoint to **85°F (29°C)**. Verify that the current draw increase as each stage is activated. (10kW has 2 stages, 15kW has 3 stages and 20kW has 4 stages).

**Cooling Mode:**

1. Set the thermostat to cooling mode and adjust the setpoint to activate Stage 1.
2. Monitoring the refrigeration gauges while the unit runs. Record the following after 10 minutes of runtime:
    1. Suction pressure
    2. Discharge pressure
    3. Duct Return temperature
    4. Duct Supply Out temperature
    5. Duct Delta T
3. Adjust the thermostat setpoint to the desired room temperature if possible, otherwise set it just low enough to allow the unit to run (ie 1°F (0.5°C) less than room temperature) and let the unit run through a cycle. Record the thermostat setpoint and the suction pressure when the unit shuts off.

**Final Inspection:**

1. Turn the power off to the unit (and plenum heater if installed) and remove all test equipment.
2. Install the electrical box cover and the access panel on the heat pump. Install the service port caps securely to prevent refrigerant loss. Install the electrical cover on the plenum heater if applicable.
3. Do a final check around the heat pump and ensure the area is clean.
4. Turn the power on to the unit and the plenum heater if installed. Set the thermostat to the final settings.

**Startup Record:**

1. The installer shall sign and date the Startup Record and have the homeowner sign as well. The installer shall leave the Startup Record with the homeowner, retain a copy for filing and send a copy to Maritime Geothermal Ltd. for warranty registration.

# Startup Record —DX-Series Single-Stage R410a

| | | | | | |
|---|---|---|---|---|---|
| **Installation Site** | | **Startup Date** | | **Installer** | |
| **City** | | | | **Company** | |
| **Province** | | **Check boxes unless asked to record data. Circle data units.** | | **Model** | |
| **Country** | | | | **Serial #** | |
| **Homeowner Name** | | **Homeowner Phone #** | | | |

## PRE-START INSPECTION

| | | |
|---|---|---|
| **Ductwork** | Ductwork is completed, dampers/ diverters are adjusted | |
| | Registers are open and clear of objects | |
| | Air filter and end cap are installed | |
| | Condensate Drain is connected, properly vented and free of debris | |
| | Plenum heater is securely fastened (if applicable) | |
| **Line Sets** | Connected to proper ports, insulated and secured in place | |
| **Domestic Hot Water** | All shut-off valves are open | |
| | Lines are full and purged | |
| | Desuperheater pump wire is disconnected | |
| **Electrical** | High voltage connections are correct and securely fastened | |
| | Circuit breaker (or fuse) size and wire gauge for Heat Pump | A Ga. |
| | Circuit breaker (or fuse) size, wire gauge, and Plenum Heater size | A Ga. kW |
| | Low voltage connections are correct and securely fastened | |
| **Unit Charge** | Refrigerant charge be fore power is turned on | Lbs kg |

## STARTUP DATA

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Preparation** | Voltage across L1 and L2, L1 and L3, L2 and L3 | | | | | | | | | | | | | | VAC |
| | Final refrigerant charge | | | | | | | | | Lbs | kg | | | | |
| **Heating Mode** | Suction | Discharge | V1 | S1 | V2 | S2 | V3 | S3 | V4 | S4 | V5 | S5 | V6 | S6 | |
| **10 minutes** | | | | | | | | | | | | | | | |
| **15 minutes** | | | | | | | | | | | | | | | °F |
| **20 minutes** | | | | | | | | | | | | | | | °C |
| **25 minutes** | | | | | | | | | | | | | | | |
| **30 minutes** | | | | | | | | | | | | | | | |
| **Average** | | | | | | | | | | | | | | | |
| | Duct Return, Duct Supply, and Delta T | | | | | | | | | In | | Out | | °F | °C |
| | Compressor L1 (black wire) current | | | | | | | | | A | | | | | |
| | Domestic Hot Water functioning | | | | | | | | | | | | | | |
| | Thermostat setpoint and discharge pressure at cycle end | | | | | | | | | °F | °C | | psig | kPa | |
| **Cooling Mode** | Suction Pressure / Discharge Pressure | | | | | | | | | | | | psig | kPa | |
| | Duct Return, Indoor Out, and Delta T | | | | | | | | | In | | Out | | °F | °C |
| | Thermostat setpoint and suction pressure at cycle end | | | | | | | | | °F | °C | | psig | kPa | |

| | | | | | |
|---|---|---|---|---|---|
| **Date:** | | **Installer Signature:** | | **Homeowner Signature:** | |

A total of three copies are required, one for the homeowner, one for the installer and on to be sent to Maritime Geothermal Ltd.

# Heating TXV Adjustment

If it is determined during the start up procedure that one or more of the heating TXV's need to be adjusted, the following procedure and record sheet should be used to ensure that adjustments are recorded and performed in a systematic way. **TABLE 13** describes what each of the columns in the Heating TXV record sheet table represents.

**TABLE 13 - TXV Adjustment Record Column Descriptions**

| Colunm | Description |
|---|---|
| **Time Actual** | **Actual time of the reading** |
| **Time EL** | **Elapsed time since the first reading** |
| **Common S** | **Suction pressure** |
| **Common ET** | **Evaporating temperature (from suction gauge or P/T chart)** |
| **Common D** | **Discharge pressure** |
| **Loop P** | **Loop TXV position. (Number of turns in from all the way out)** |
| **Loop V** | **Loop Vapour Line temperature** |
| **Loop S** | **Loop Superheat (Vapour Line temperature - Evaporating temperature** |
| **TXV #** | **The TXV that is being adjusted** |
| **Turns** | **The number of turns the TXV is being adjusted** |
| **In/Out** | **The direction the TXV is being adjusted (In=clockwise, OUT=counter-clockwise)** |

**The heating TXV's are set to four turns in from all the way out at the factory.** This should be sufficient for most installations, however it is sometimes necessary to make adjustments if the ground conditions vary or if the loop lengths vary. The procedure below explains how to properly adjust the TXV's so that the task can be completed in the minimum amount of time.

- The goal is to obtain a superheat value **of 8-14°F (4-8°C)** on each evaporator loop. It is good practice to average out the last few readings as the TXV's tend to cycle, causing the superheat to vary.
- Adjusting a TXV **in** (clockwise) increases the superheat of its evaporator loop. Adjusting a TXV **out** (counter-clockwise) decreases the superheat of its evaporator loop.
- Adjusting one TXV affects the remaining evaporator loops, adjustments must be small and done to only one TXV at a time.
- Adjustments are done every other time interval (ie every 10 minutes). The next two intervals should be averaged together for the next adjustment.
- Always adjust the TXV that is the furthest out.

## ADJUSTMENT PROCEDURE

1. Fill in the information section at the top of the adjustment record sheet. Circle °F or °C at the top right.
2. Record all data for the initial readings (elapsed time 0). Adjust the TXV for the loop that is the furthest out. Record the number of the TXV, how much it was adjusted in turns (ie 1/4, 1/2, 1), and in which direction it was adjusted. Record the new position of the adjusted TXV in the appropriate P column of the next row. Record the remaining TXV positions in their individual P columns in the next row.
3. At the next time interval, record the data in the current row. Verify that the superheat of the adjusted TXV has changed in the desired direction. Do not adjust the TXV. Mark —- in the TXV #, Turns, and In/Out columns.
4. At the next time interval, record all data. Adjust the TXV that is the furthest out. Record the TXV #, Turns and In/Out values. Record the new position of the adjusted TXV in the appropriate P column of the next row. Record the remaining TXV positions in their individual P columns in the next row.
5. Repeat Steps 2 and 3 until all superheat values are within **8-14°F (4-8°C)**.

# Heating TXV Adjustment Record - DX-Series Size 25-65 Single-Stage R22

| Installation Site | | City | | Province | | Country | | Serial # | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Installer | | Company | | Date | | Model | | | | °F °C |

| TIME | | COMMON | | | LOOP 1 | | | LOOP 2 | | | LOOP 3 | | | LOOP 4 | | | LOOP 5 | | | LOOP 6 | | | ADJUSTMENT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Actual | EL | S | ET | D | P1 | V1 | S1 | P2 | V2 | S2 | P3 | V3 | S3 | P4 | V4 | S4 | P5 | V5 | S5 | P6 | V6 | S6 | TXV # | Turns | In/Out |
| | 0 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 10 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 20 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 25 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 30 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 35 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 45 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 50 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 55 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 60 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 65 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 70 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 75 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 80 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 85 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 90 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 95 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 100 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 105 | | | | | | | | | | | | | | | | | | | | | | | | |

# General Maintenance

| GENERAL MAINTENANCE SCHEDULE | | |
|---|---|---|
| **Item** | **Interval** | **Procedure** |
| **Air Filter** | 6 months | Inspect for dirt. Replace if necessary. |
| **Contactor** | 1 year | Inspect for pitted or burned points. Replace if necessary. |
| **Condensate Drain** | 1 year | Inspect for clogs. Remove and clean if necessary. |

# Troubleshooting Guide

**The following steps are for troubleshooting the geothermal heat pump. If the problem is with the domestic hot water or the plenum heater, proceed to those sections at the end of the troubleshooting guide. Repair procedures and reference refrigeration circuit diagrams can be found at the end of the troubleshooting guide.**

**STEP 1:** Verify that the display is present on the thermostat. If it is not, proceed to POWER SUPPLY TROUBLE SHOOTING, otherwise proceed to STEP 2.

**STEP 2:** Remove the door and electrical box cover and check to see if the HI or LOW LED's are flashing or on. Record The results . Turn the power off, wait 10 seconds and turn the power back on.

**STEP 3:** Set the thermostat to call for heating or cooling depending on the season, If a 24VAC signal does not appear across Y1 and C of the terminal strip within 6 minutes, proceed to the THERMOSTAT TROUBLESHOOTING section, otherwise proceed to STEP 4.

**STEP 4:** If the HI or LOW LEDs flash and the compressor does not attempt to start, proceed to the SAFETY CONTROL TROUBLESHOOTING section, otherwise proceed to STEP 5.

**STEP 5:** If HI or LOW pressure LED's are not flashing and the compressor does not attempt to start, attempts to start but cannot, starts hard, or starts but does not sound normal, proceed to the COMPRESSOR TROUBLESHOOTING section, otherwise proceed to STEP 6.

**STEP 6:** If the compressor starts and sounds normal, this means the compressor is OK and the problem lies elsewhere. Proceed to the OPERATION TROUBLESHOOTING section.

| POWER SUPPLY TROUBLESHOOTING | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **No power to the heat pump** | Disconnect switch open (if installed). | Verify disconnect switch is in the ON position. | Determine why the disconnect switch was opened, if all is OK close the switch. |
| | Fuse blown / Breaker Tripped. | At heat pump disconnect box, voltmeter shows 230VAC on the line side but not on the load side. | Reset breaker or replace fuse with proper size and type. (Time-delay type "D"). |
| **No display on thermostat** | Blown Primary or Secondary fuse on transformer. | Visually inspect. Remove fuse and check for continuity if in doubt. | Replace fuse. |
| | Blown fuse on control board. | Visually inspect. Remove fuse and check for continuity if in doubt. | Replace fuse. |
| | Faulty transformer. | 230VAC is present across H1 and H4 of the transformer but 24VAC is not present across X1 and X4 of the transformer. | Replace transformer. |
| | Faulty wiring between heat pump and thermostat. | 24VAC is not present across C and R($R_H$) of the thermostat. | Correct the wiring. |
| | Faulty Thermostat. | 24VAC is present across C and R ($R_H$) of the thermostat but thermostat has no display. | Replace thermostat. |

| THERMOSTAT TROUBLESHOOTING | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **No Y1 signal to heat pump (after 6 minutes)** | Incorrect thermostat set-up. | Thermostat does not indicate a call for heat. No 24VAC signal present across C and Stage 1 of the thermostat. | Correct the setup. |
| | Faulty thermostat to heat pump wiring. | 24VAC signal present across Stage 1 and C of the thermostat but not present across Y1 and C of the terminal strip. | Correct or replace wiring. |
| | Faulty thermostat. | No 24VAC between Stage 1 and C of the thermostat when a call is indicated on the thermostat. | Replace thermostat. |

| SAFETY CONTROLS TROUBLESHOOTING | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **High Pressure Control** | Faulty High Pressure Control (open).<br>*HP pressures must be at static levels. | Hi LED is flashing. Short H to H on the connector at the left of the control board and verify whether the LED stops flashing or remains flashing. | Replace high pressure control if LED stops flashing, replace control board if it does not. |
| **Low Pressure Control** | Faulty Low pressure control (open).<br>* Must be a signal present on Y1 for this test.<br>*HP pressures must be at static levels. | Lo LED is flashing. Short L to L on the connector at the left of the control board and verify whether the LED stops flashing or remains flashing. | Replace low pressure control if LED stops flashing, replace control board if it does not. |
| | Unit out of refrigerant. | Check static refrigeration pressure of the unit for a very low value. | Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak. |

| COMPRESSOR TROUBLESHOOTING | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **Compressor will not start** | Manual High pressure control tripped. | Press the button on the control, it will click when pressed. | Proceed to Operation Trouble-shooting. |
| | Faulty control board. | Hi and Low LED's off, HB is flashing but Y LED is not on, or no 24VAC across Y and C of bottom right connector. | Replace control board. |
| | Faulty run capacitor. (Single phase only) | Check value with capacitance meter. Should match label on capacitor. Compressor will hum while trying to start and then trip its overload. | Replace if faulty. |
| | Loose or faulty wiring. | Check all compressor wiring, including inside compressor electrical box. | Fix any loose connections. Replace any damaged wires. |
| | Faulty compressor contactor. | Voltage on line side with contactor held closed, but no voltage on one or both terminals on the load side. Points pitted or burned. Or, 24VAC across coil but contactor will not engage. | Replace contactor. |
| | Thermal overload on compressor tripped. | Ohmmeter shows reading when placed across R and S terminals and infinity between C & R or C & S. A valid resistance reading is present again after the compressor has cooled down. | Proceed to Operation Trouble-shooting to determine the cause of the thermal overload trip. |
| | Burned out motor. (open winding) | Remove wires from compressor. Ohmmeter shows infinite resistance between any two terminals Note: Be sure compressor overload has had a chance to reset. If compressor is hot this may take several hours. | Replace the compressor. |
| | Burned out motor. (shorted windings) | Remove wires from compressor. Resistance between any two terminals is below the specified value. | Replace the compressor. |
| | Motor shorted to ground. | Remove wires from compressor. Check for infinite resistance between each terminal and ground. | If any terminal to ground is not infinite replace the compressor. |
| | Seized compressor due to locked or damaged mechanism. | Compressor attempts to start but trips its internal overload after a few seconds. (Run capacitor already verified) | Attempt to "rock" compressor free. If normal operation cannot be established, replace compressor. |
| **Compressor starts hard** | Start capacitor faulty. (Single phase only) | Check with capacitance meter. Check for black residue around blowout hole on top of capacitor. | Replace if faulty. Remove black residue in electrical box if any. |
| | Potential Relay faulty. (Single phase only) | Replace with new one and verify compressor starts properly. | Replace if faulty. |
| | Compressor is "tight" due to damaged mechanism | Compressor attempts to start but trips its internal overload after a few seconds. Run capacitor has been verified already. | Attempt to "rock" compressor free. If normal operation cannot be established, replace compressor. |
| | | | |

| OPERATION TROUBLESHOOTING - HEATING MODE | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **High Discharge Pressure** | Air Flow. | See Fan Troubleshooting section. | Correct the problem. |
| | Heating TXV's adjusted too far closed. | Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be high if TXV's are closed too far. | Adjust TXV to obtain 8-14°F (3-8°C) superheat. |
| | One or more heating TXV's stuck (too far closed). | Adjusting the TXV does not affect the superheat or the suction pressure. | Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work. |
| | Faulty Normally Open solenoid valve (stuck closed). | A click can be heard when the coil is energized but the valve is cold instead of warm. | Replace NO valve. |
| | Filter-drier plugged. | Feel each end of the filter- drier, it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure. | Replace filter-drier. |
| | Unit is overcharged. | High sub-cooling, low delta T across air coil. | Remove 1/2lb of refrigerant at a time and verify that the discharge pressure reduces. |
| **Surging Discharge Pressure** | Heating TXV's adjusted too far closed. | Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be high if TXV is closed too far. | Adjust TXV to obtain 8-14°F (3-8°C) superheat. |
| **Low Suction Pressure** | Heating TXV's adjusted too far closed. | Adjusting the TXV does not affect the superheat or the suction pressure. TXV may be frosting up. | Adjust TXV to obtain 8-14°F (3-8°C) superheat. |
| | One or more heating TXV's stuck (too far closed). | Adjusting the TXV does not affect the superheat or the suction pressure. | Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work. |
| | Faulty Normally Open solenoid valve (stuck closed). ** May actually draw a vacuum.** | A click can be heard when the coil is energized but the valve is cold instead of warm. | Replace NO valve. |
| | Filter-drier plugged. | Feel each end of the filter- drier, it should be the same temperature. If there is a temperature difference then it is plugged. Also causes low suction pressure. | Replace filter-drier. |
| | Low refrigerant charge. | Check static refrigeration pressure of the unit for a very low value. Low discharge pressure when running. | Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak. |
| | Faulty compressor, not pumping. | Pressures change only slightly from static values when compressor is started. | Replace compressor. |

| OPERATION TROUBLESHOOTING - HEATING MODE | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **Low Suction Pressure (continued)** | Loop piping interchanged (ie Loop 1 connected between Vapour 1 and Liquid 2) | Affected TXV's do not seem to operate properly. Switch to cooling mode and verify all liquid line temperatures for each individual loop switch. The liquid line for the loop in use should be warmer than the others, If loops are interchanged, the wrong liquid line will be warmer. | Pump the unit down and swap the interchanged lines. |
| | Loop field too small | Charge is good, superheats are good, vapor line temperatures are low. | Increase loop size. |
| **High Suction Pressure (may appear to not be pumping)** | Leaking reversing valve. | Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot. | Replace reversing valve. |
| | Heating TXV's adjusted too far open. | Verify superheat. It should be between 8-14°F (3-8°C). Superheat will be lowh if TXV's are open too far. | Adjust TXV to obtain 8-14°F (3-8°C) superheat. |
| | One or more heating TXV's stuck (too far open). | Adjusting the TXV does not affect the superheat of the loop or the suction pressure. Low super heat, low discharge pressure. | Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work. |
| | Faulty cooling check valve (leaking) | Also low discharge pressure. Switch to cooling mode. Unit operates correctly when loop is in use. Loop lines get cold when loop not in use instead of warming to ambient, compressor frosts up. | Identify the check valve. Try switching modes a few times. Replace if problem continues. |
| **Compressor frosting up** | See Low Suction Pressure in this section. | | |
| **Heating TXV frosting up heavily** | TXV stuck almost closed or partially blocked by foreign object. | Adjusting the TXV does not affect the superheat or the suction pressure. | Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work. |
| **Random high pressure trip (does not occur while on site)** | Intermittent fan. | See Fan Troubleshooting section. | Correct the problem. |
| **Random manual high pressure trip (does not occur while on site)** | Faulty compressor contactor. | Points pitted or burned. Contactor sometimes sticks causing the compressor to run without the fan, tripping the high pressure control. | Replace contactor. |

| OPERATION TROUBLESHOOTING - COOLING MODE | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **Heating instead of cooling** | Thermostat not set up properly. | Verify that there is 24VAC across O/B/W1 and C of the terminal strip when calling for cooling. | Correct thermostat setup. Change to a different thermostat. |
| | Faulty reversing valve solenoid coil. | Verify solenoid by removing it from the shaft while the unit is running. There should be a loud “whoosh” sound when it is removed. Discharge pressure will continue to rise even if there is a loop switch. | Replace solenoid if faulty. |
| | Faulty reversing valve. | A click can be heard when the coil is energized but hot gas is still directed to the air coil. Discharge pressure will continue to rise even if there is a loop switch. | Replace reversing valve. |
| **High Pressure control trips** | Faulty Loop Pressure switch | Loop LED does not come on around **480PSIG**. Shorting S and S causes the LED to come on. | Replace loop pressure switch. |
| | Faulty Loop Pressure switch Input | Shorting S and S does not cause the Loop Switch LED to come on, or does not cause a loop change. | Replace the control board. |
| **High Pressure control and manual high pressure control trips (very fast)** | Faulty reclaim valve solenoid. | Verify solenoid by removing it from the shaft while energized. If there is no click the solenoid is bad | Replace reclaim solenoid coil. |
| | Faulty reclaim valve. | A click can be heard when the valve is selected but the unit still trips out. | Replace the reclaim valve |
| | Faulty control board output. (L1 to L5). | Loop LED does not come on or there is no 24VAC across the loop output and C of the control board when the loop is selected. | Replace the control board. |
| **Loop changes occur too frequently** | Faulty NO Solenoid coil or valve. | Continuous loop changing (every 7 seconds) in two loop mode, high suction pressure, hot compressor. | With O energized (compressor off) slide the coil up and down the shaft. If clicking can be heard the coil is OK. |
| | Cooling TXV adjusted too far closed or stuck or partially blocked | Continuous loop changing (every 7 seconds) in two loop mode, low suction pressure. | Adjust TXV or replace if faulty. |
| | Unit overcharged. | Frequent loop changes. Switch to heating mode to confirm. | Remove refrigerant 1/2 pound at a time in heating mode. |
| | Loop field saturated | Frequent loop changes in two loop mode after some season runtime. | Install soaker hose. |
| | Loop field too small | Frequent loop changes in two loop mode after some season runtime. | Increase loop size. |

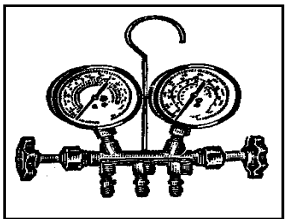
| OPERATION TROUBLESHOOTING - COOLING MODE | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **High Suction Pressure (may appear to not be pumping)** | Cooling TXV adjusted too far open. | Verify superheat. It should be between 8-12°F (3-6°C). Superheat will be low if TXV is open too far. | Adjust TXV to obtain 8-12°F (3-6°C) superheat. |
| | Cooling TXV stuck open. | Adjusting the TXV does not affect the superheat or the suction pressure. Low super heat and discharge pressure. | Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work. |
| | Leaking reversing valve. | Reversing valve is the same temperature on both ends of body, common suction line is warm, compressor is running hot. | Replace reversing valve. |
| | Leaking reclaim valve. | Scavenger line remains hot where it enters the common suction line. | Replace reclaim valve. |
| **Low Suction Pressure** | Air Flow | See Fan Troubleshooting section. **Note:** low airflow will cause the air coil to ice up once the suction drops below **90PSIG**. | Correct the problem. |
| | Cooling TXV stuck almost closed or partially blocked by foreign object. | Adjusting the TXV does not affect the superheat or the suction pressure. TXV may be frosting up. | Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work. |
| | Low or no refrigerant charge. | Entering air temperature and airflow are good but suction is low. Check static refrigeration pressure of unit for very low value. | Locate the leak and repair it. Spray nine, a sniffer and dye are common methods of locating a leak. |
| | Leaking cooling check valve | Unit operates correctly when loop is in use. Loop lines get cold when loop not in use instead of warming to ambient, compressor frosts up. | Identify the check valve. Try switching modes a few times. Replace if problem continues. |
| | Faulty NO solenoid valve coil. | Verify solenoid by removing it from the shaft while the unit is running. There should be an audible click sound if the solenoid is working. | Replace solenoid if faulty. |
| | Faulty NO solenoid valve. | A click can be heard when the coil is energized. Unused loops stay cold instead of gradually warming to ambient. Compressor frosts up. | Replace NO valve. |
| | Faulty compressor, not pumping. | Pressures change only slightly from static values when compressor is started. | Replace compressor. |
| **Compressor frosting up** | See Low Suction Pressure in this section. | | |
| **TXV frosting up** | TXV stuck almost closed or partially blocked by foreign object. | Adjusting the TXV does not affect the superheat or the suction pressure. | Adjust the TXV all the way in and out a few times to loosen it. Replace TXV if this does not work. |
| **Random Low Pressure trip (does not occur while there)** | Faulty compressor contactor. | Points pitted or burned. Contactor sometimes sticks causing the compressor to run without the fan, tripping the low pressure control. | Replace contactor. |
| | Intermittent fan. | See Fan Troubleshooting section. | Correct the problem. |

| FAN TROUBLESHOOTING | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **Low Airflow** | Dirty air filter | Inspect. | Replace. |
| | Dirty air coil. | Inspect. | Clean. |
| | Poor Ductwork | Measure delta T between supply and return ducts at the unit, it in heating mode, it should not be above 30°F(17°C). | The ECM fan will provide proper airflow up to 0.5 inH2o for 1/2HP motors and 0.7 inH2o for 1HP motors. The ductwork is poorly designed or greatly undersized if the fan motor cannot provide the required airflow. |
| | Air flow selected on Tap Board is too low. | Check selection on Air Flow Tap Board. | Select a higher setting. |
| | Air flow reduction is enabled. | AR1 and AR2 are connected with a dry contact. | Air flow reduction may not be feasible with poor ductwork, and/or lower Air Flow selections. Increase settings until unit operates properly. |
| **Fan operating on wrong Stage speed** | Fan Control Signal Harness is loose. | Verify that the connector is properly inserted into the fan motor. Gently tug on each wire to verify it is properly inserted into the connector. | Repair any loose connections. |
| | Faulty Control Signal Harness or faulty motor head. | Measure 24VAC between White (pin 3) and the following at the fan control signal harness (insert probes in connector where wire is inserted, do not unplug the connector):<br>Circulation = Grey (pin 15)<br>Stage 1 = Yellow (pin 6)<br>Stage 2=Yellow/Black (pin14)<br>Stage 3 = Violet (pin 2) | If proper signal isn't present, replace Fan Control Signal Harness. If proper signal is present, replace fan motor head. |
| **Fan not operating or operating intermittently** | Fan Control Signal Harness and/or Fan Power Harness is loose. | Verify that the connector is properly inserted into the fan motor. Gently tug on each wire to verify it is properly inserted into the connector. | Repair any loose connections. |
| | Faulty Control Signal Harness or;<br>Faulty motor head. | Measure 24VAC between White (pin 3) and the following at the fan control signal harness (insert probes in connector where wire is inserted, do not unplug the connector):<br>Circulation = Grey (pin 15)<br>Stage 1 = Yellow (pin 6)<br>Stage 2=Yellow/Black (pin14)<br>Stage 3 = Violet (pin 2) | If proper signal isn't present, replace Fan Control Signal Harness. If proper signal is present, replace fan motor head. |
| | Fan Power Harness faulty or;<br>Faulty motor. | Insert the tips of the voltmeter probes into the back of the connector at the fan to measure the voltage across the red and black wires, value should be 230VAC | Replace Power Harness if 230VAC is not present, replace motor if 230VAC is present |

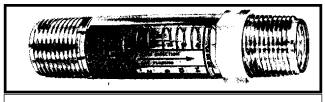
| PLENUM HEATER TROUBLE SHOOTING | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **No 230VAC across plenum heater L1 and L2** | Disconnect switch open. (if installed) | Verify disconnect switch is in the ON position. | Determine why the disconnect switch was opened, if all is OK close the switch. |
| | Fuse blown / Breaker Tripped. | At plenum heater disconnect box (if installed), voltmeter shows voltage on the line side but not on the load side. Check if breaker is tripped. | Reset breaker or replace fuse at plenum heater disconnect box. Replace fuse with proper size and type. (Time-delay type “D”) |
| | Same “Line” to L1 and L2 | Measuring L1 to ground and L2 to ground both yield 115VAC, but L1 to L2 yields 0VAC. | Correct wiring. |
| **No W2 signal at Heat pump terminal strip** | No call for auxiliary or emergency heat from thermostat. | Verify that the thermostat is indicating that auxiliary or emergency heat should be on. | Set thermostat to engage auxiliary or emergency heat (note some thermostats require a jumper between auxiliary and emergency. Check the thermostat manual). |
| | Faulty thermostat. | Thermostat doesn’t indicate a call for auxiliary or emergency when it should. | Replace thermostat. |
| | Faulty thermostat. | Thermostat indicates auxiliary or emergency but no 24VAC signal present across C and the auxiliary and/or emergency pin at the thermostat. | Replace thermostat. |
| | Faulty thermostat wiring. | 24VAC signal is present across C and the auxiliary and/or emergency pin at the thermostat but no 24VAC signal is present across W2 and C at the heat pump terminal strip. | Correct wiring. |
| **No 24VAC signal from C to ground at the plenum heater control connector** | Plenum Heater transformer is burned out. | Voltmeter does not show 24VAC across transformer secondary winding. | Replace transformer. |
| | Plenum heater control board is faulty. | Transformer tested OK in previous step. | Replace control board. |
| **No 24VAC signal from 1 to ground at the plenum heater control connector** | Faulty wiring. | 24VAC present across C and ground at the plenum heater, but not across ground of the plenum heater and I of the heat pump terminal strip | Correct wiring. |
| | Faulty wiring. | If previous step tested OK, 24VAC is present across ground of the plenum heart and 1 of the heat pump terminal strip, but not across ground of the plenum heater and 1 of the plenum heater. | Correct wiring. |

| PLENUM HEATER TROUBLE SHOOTING | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **No 24VAC signal from 1 to ground at the plenum heater control connector** | Faulty Plenum Heater Relay in heat pump | 24VAC is present across pin 1 and pin 3 of the relay, 24VAC is present from heat pump terminal strip I to plenum heater ground, but not from heat pump terminal strip 1 to plenum heater ground. | Replace relay. |
| **Thermal overload is tripped.** | Fan not operating. | See Fan Not Operating section. | Correct problem. Reset thermal overload. |
| | Faulty overload | Reset thermal overload | Replace if faulty. |

| DOMESTIC HOT WATER (DHW) TROUBLE SHOOTING | | | |
|---|---|---|---|
| **Fault** | **Possible Cause** | **Verification** | **Recommended Action** |
| **Insufficient hot water (Tank Problem)** | Thermostat on hot water tank set too low. Should be set at 120°F. (140°F if required by local code) | Visually inspect the setting. | Readjust the setting to 120°F. (140°F if required by local code) |
| | Breaker tripped, or fuse blown in electrical supply to hot water tank. | Check both line and load sides of fuses. If switch is open determine why. | Replace blown fuse or reset breaker. |
| | Reset button tripped on hot water tank. | Check voltage at elements with multimeter. | Push reset button. |
| **Insufficient hot water (Heat Pump Problem)** | Circulator pump not operating. | Visually inspect the pump to see if shaft is turning. Use an amprobe to measure current draw. | Replace if faulty. |
| | Blockage or restriction in the water line or hot water heat exchanger. | Check water flow and power to pump. Check water lines for obstruction | Remove obstruction in water lines. Acid treat the domestic hot water coil. |
| | Faulty DHW cutout (failed open). | Check contact operation. Should close at 120°F and open at 140°F. | Replace DHW cutout if faulty. |
| | Heat pump not running enough hours to make sufficient hot water. | Note the amount of time the heat pump runs in any given hour. | Temporarily turn up the tank thermostats until colder weather creates longer run cycles. |
| **Water is too hot.** | Faulty DHW cutout (failed closed). | Check contact operation. Should close at 120°F and open at 140°F. | Replace DHW cutout if faulty. |
| | Thermostat on hot water tank set too high. Should be set at 120°F. (140°F if required by local code) | Visually inspect the setting. | Readjust the setting to 120°F. (140°F if required by local code) |

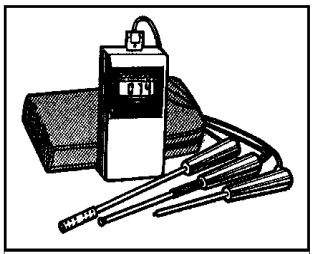


Refrigeration

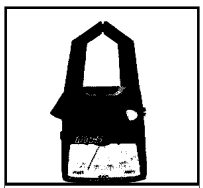


In-line Flowmeter

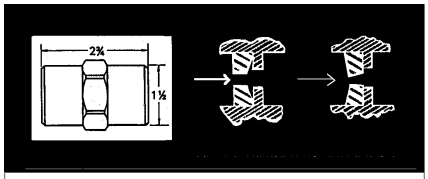
## Trouble Shooting Tools



Digital



Multimeter - Voltmeter /




Dole flow control Valve

The Dole® flow control is a simple, self-cleaning device designed to deliver a constant volume of water from any outlet whether the pressure is 15 psig or as high as 125 psi. The controlling mechanism consists of a flexible orifice that varies its area inversely with pressure so that a constant flow is maintained.

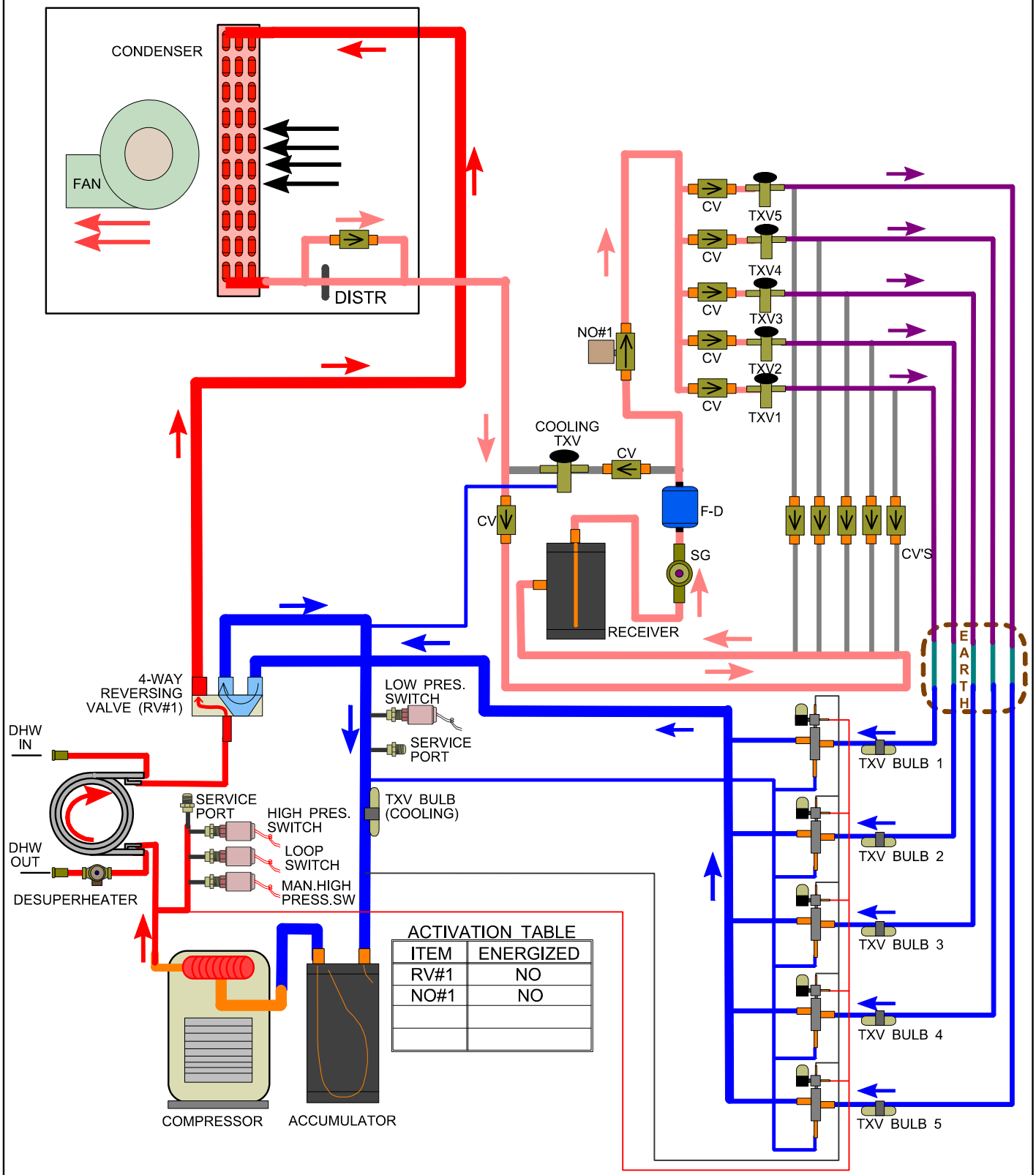
# *REPAIR PROCEDURES*

| PUMP DOWN PROCEDURE | |
|---|---|
| **STEP 1** | Connect the refrigerant recovery unit to the heat pump service ports via a refrigeration charging manifold and to a recovery tank as per the instructions in the recovery unit manual. **If there was a compressor burn out, the refrigerant cannot be reused and must be disposed of according to local codes.** |
| **STEP 2** | Ensure all hose connections are properly purged of air. Start the refrigerant recovery as per the instructions in the recovery unit manual. |
| **STEP 3** | Allow the recovery unit suction pressure to reach a vacuum. Once achieved, close the charging manifold valves. Shut down, purge and disconnect the recovery unit as per the instructions in its manual. Ensure the recovery tank valve is closed before disconnecting the hose to it. |
| **STEP 4** | Connect a nitrogen tank to the charging manifold and add nitrogen to the heat pump until a positive pressure of 5-10PSIG is reached. This prevents air from being sucked into the unit by the vacuum when the hoses are disconnected. |
| **STEP 5** | The heat pump is now ready for repairs. Always ensure nitrogen is flowing through the system during any soldering procedures to prevent soot buildup inside the pipes. Maritime Geothermal Ltd. recommends replacing the liquid line filter-drier anytime the refrigeration system has been exposed to the atmosphere. |

| VACUUM AND CHARGING PROCEDURE | |
|---|---|
| **STEP 1** | After completion of repairs and nitrogen pressure testing, the refrigeration circuit is ready for vacuuming. |
| **STEP 2** | Release the refrigerant circuit pressure and connect the vacuum pump to the charging manifold. Start the vacuum pump and open the charging manifold valves. Vacuum until the vacuum gauge remains at less than 500 microns for at least 1 minute with the vacuum pump valve closed. |
| **STEP 3** | Close the charging manifold valves then shut off and disconnect the vacuum pump. Place a refrigerant tank with the proper refrigerant on a scale and connect it to the charging manifold. Purge the hose to the tank. |
| **STEP 4** | Weigh in the appropriate amount of refrigerant through the low pressure (suction) service port. Refer to the label on the unit or the **Charging The system** section for the proper charge amount. |
| **STEP 5** | If the unit will not accept the entire charge, the remainder can be added through the low pressure service port after the unit has been restarted. |

| REPLACMENT PROCEDURE FOR A COMPRESSOR BURN-OUT | |
|---|---|
| **STEP 1** | Pump down the unit as per the Pump Down Procedure above. |
| **STEP 2** | Replace the compressor. Replace the liquid line filter-drier. |
| **STEP 3** | Vacuum the unit until it remains under 500 microns for several minutes with the vacuum pump valve closed. |
| **STEP 4** | Charge the unit and operate it for continuously for 2 hours. Pump down the unit and replace the filter-drier. Vacuum the unit until it remains under 500 microns for several minutes with the vacuum pump valve closed. |
| **STEP 5** | Charge the unit (refrigerant can be re-used) and operate it for 2-3 days. Pump down the unit and replace the filter-drier. |
| **STEP 6** | Charge the unit (refrigerant can be re-used) and operate it for 2 weeks. Pump down the unit and replace the filter-drier. |
| **STEP 7** | Charge the unit a final time. Unit should now be clean and repeated future burn-outs can be avoided. |

# DX (Modular-TXV) REFRIGERATION CIRCUIT - HEATING MODE




ACTIVATION TABLE

| ITEM | ENERGIZED |
|---|---|
| RV#1 | NO |
| NO#1 | NO |
| | |
| | |

| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| 02 | 000195 | D. RHEAULT | D. RHEAULT | 1-Jun-2012 |
| 01 | Initial Release | D. RHEAULT | D. RHEAULT | 2-Nov-2011 |

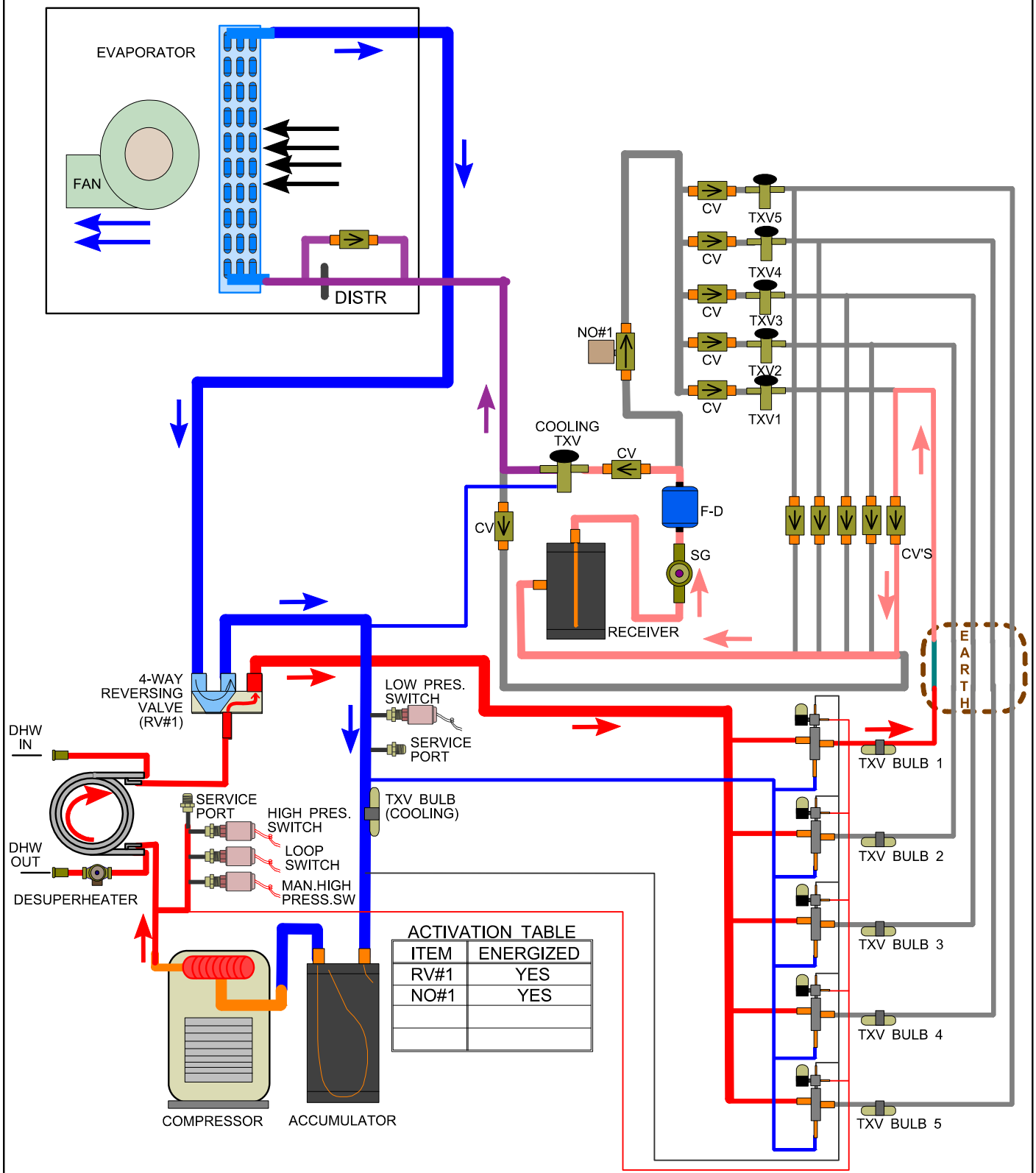
| | | |
|---|---|---|
| Drawn By D. RHEAULT | Date 2-Nov-2011 | |
| Checked By D. RHEAULT | Date 2-Nov-2011 | |
| Approved By (ENG) D. RHEAULT | Date 2-Nov-2011 | |
| Approved By (MFG) | Date | |
| Approved By | Date | |

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: DX (Modular - TXV) Refrigeration Circuit - Heating Mode

| Size | Drawing Number | REV | SHEET |
|---|---|---|---|
| A | 001576RCD | 02 | 1 of 1 |

# DX (Modular-TXV) REFRIGERATION CIRCUIT - COOLING MODE




ACTIVATION TABLE

| ITEM | ENERGIZED |
|---|---|
| RV#1 | YES |
| NO#1 | YES |
| | |
| | |

| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| 02 | 000195 | D. RHEAULT | D. RHEAULT | 1-Jun-2012 |
| 01 | Initial Release | D. RHEAULT | D. RHEAULT | 2-Nov-2011 |

| | | |
|---|---|---|
| Drawn By D. RHEAULT | | Date 2-Nov-2011 |
| Checked By D. RHEAULT | | Date 2-Nov-2011 |
| Approved By D. RHEAULT | (ENG) | Date 2-Nov-2011 |
| Approved By | (MFG) | Date |
| Approved By | | Date |

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: DX (Modular - TXV) Refrigeration Circuit - Cooling Mode

| Size | Drawing Number | REV | SHEET |
|---|---|---|---|
| A | 001577RCD | 02 | 1 of 1 |

# Model Specific Information

This section provides general information particular to each model. For complete specifications please see the specifications document for the desired model

## REFRIGERANT CHARGE CHART

**Table 18 - Refrigerant - R410a**

| SIZE | Lbs. | kg |
|---|---|---|
| **25** | 8.0 | 3.6 |
| **45** | 12.0 | 7.3 |
| **55** | 16.0 | 9.1 |
| **65** | 20.0 | 9.1 |

System contains POE oil.

## SHIPPING INFORMATION

**Table 19 - Shipping Information**

| MODEL | WEIGHT | DIMENSIONS in (cm) | | |
|---|---|---|---|---|
| SIZE | Lbs. (kg) | L | W | H |
| **25** | TBD | 40 (102) | 36 (91) | 60 (152) |
| **45** | TBD | 40 (102) | 36 (91) | 60 (152) |
| **55** | TBD | 40 (102) | 36 (91) | 60 (152) |
| **65** | TBD | 40 (102) | 36 (91) | 60 (152) |

## STADARD CAPACITY RATINGS

The tables below depict the results of standard capacity rating tests according to ARI 870-2005.

**Table 14 - Standard Capacity Ratings - Heating 60Hz**

EAT 70°F (21.1°C) VAPOUR LINE 32°F (0°C)

| Model | Size | Mode | Airflow | | Input Energy | Capacity | | $COP_H$ |
|---|---|---|---|---|---|---|---|---|
| | Tons | | CFM | L/s | Watts | BTU/Hr | kW | W/W |
| **25** | **2** | **Stage 1** | **800** | **378** | **1,435** | **17,700** | **5.2** | **3.60** |
| **45** | **3** | **Stage 1** | **1200** | **566** | **2,285** | **31,100** | **9.1** | **3.99** |
| **55** | **4** | **Stage 1** | **1500** | **708** | **3,375** | **43,500** | **12.7** | **3.78** |
| **65** | **5** | **Stage 1** | **1900** | **897** | **4,180** | **53,300** | **15.6** | **3.74** |

**Table 15 - Standard Capacity Ratings - Cooling 60Hz**

EAT 80°F (26.7°C) LIQUID LINE 77°F (25°C)

| Model | Size | Mode | Airflow | | Input Energy | Capacity | | EER |
|---|---|---|---|---|---|---|---|---|
| | Tons | | CFM | L/s | Watts | BTU/Hr | kW | BTU/W-Hr |
| **25** | **2** | **Stage 1** | **800** | **378** | **1,295** | **24,900** | **7.3** | **19.3** |
| **45** | **3** | **Stage 1** | **1200** | **566** | **2,240** | **43,200** | **12.6** | **19.3** |
| **55** | **4** | **Stage 1** | **1500** | **708** | **2,900** | **51,500** | **15.1** | **17.8** |
| **65** | **5** | **Stage 1** | **1900** | **897** | **3,620** | **63,900** | **18.7** | **17.6** |

# CAPACITY RATINGS

## DX-25-HACW-P-1S — Heating Mode (Nominal 2 ton) — R410a 60 Hz

| Source Data (Outdoor Loop) | | | Power Consumption | | | | | Sink Data (Indoor Loop) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Suction Pres-sure | Evap. Temp | HAB | Compressor | | Fan* | Total Electrical | COPh | Discharge Pressure | Cond. Temp. | EAT | Air Flow | LAT | Delta T | Net Output |
| PSIG | °F | BTU/Hr | Watts | Amps | Watts | Watts | W/W | PSIG | °F | °F | CFM | °F | °F | BTU/Hr |
| kPa | °C | Watts | | | | | | kPa | °C | °C | L/sec | °C | °C | Watts |
| 62 | 10 | 8,983 | 1,184 | 5.3 | 105 | 1,289 | **3.04** | 280 | 91 | 70.0 | 1,000 | 83.6 | 13.6 | **13,383** |
| 430 | -12.2 | 2,632 | | | | | | 1927 | 32.8 | 21.1 | 472 | 28.7 | 7.5 | **3,921** |
| 70 | 15 | 9,885 | 1,222 | 5.5 | 105 | 1,327 | **3.18** | 288 | 93 | 70.0 | 1,000 | 84.6 | 14.6 | **14,413** |
| 484 | -9.4 | 2,896 | | | | | | 1985 | 33.9 | 21.1 | 472 | 29.2 | 8.1 | **4,223** |
| 79 | 20 | 10,856 | 1,259 | 5.7 | 105 | 1,364 | **3.33** | 296 | 95 | 70.0 | 1,000 | 85.7 | 15.7 | **15,511** |
| 543 | -6.7 | 3,181 | | | | | | 2044 | 35.0 | 21.1 | 472 | 29.9 | 8.7 | **4,545** |
| 88 | 25 | 11,899 | 1,296 | 5.9 | 105 | 1,401 | **3.49** | 305 | 97 | 70.0 | 1,000 | 86.9 | 16.9 | **16,681** |
| 605 | -3.9 | 3,486 | | | | | | 2104 | 36.1 | 21.1 | 472 | 30.5 | 9.4 | **4,888** |
| 97 | 30 | 13,015 | 1,334 | 6.0 | 105 | 1,439 | **3.65** | 314 | 99 | 70.0 | 1,000 | 88.2 | 18.2 | **17,927** |
| 672 | -1.1 | 3,813 | | | | | | 2165 | 37.2 | 21.1 | 472 | 31.2 | 10.1 | **5,252** |
| 108 | 35 | 14,207 | 1,372 | 6.2 | 105 | 1,477 | **3.82** | 323 | 101 | 70.0 | 1,000 | 89.5 | 19.5 | **19,249** |
| 743 | 1.7 | 4,163 | | | | | | 2228 | 38.3 | 21.1 | 472 | 32.0 | 10.9 | **5,640** |
| 119 | 40 | 15,476 | 1,412 | 6.4 | 105 | 1,517 | **3.99** | 332 | 103 | 70.0 | 1,000 | 91.0 | 21.0 | **20,652** |
| 819 | 4.4 | 4,535 | | | | | | 2292 | 39.4 | 21.1 | 472 | 32.8 | 11.6 | **6,051** |
| 131 | 45 | 16,825 | 1,452 | 6.6 | 105 | 1,557 | **4.17** | 342 | 105 | 70.0 | 1,000 | 92.5 | 22.5 | **22,139** |
| 900 | 7.2 | 4,930 | | | | | | 2357 | 40.6 | 21.1 | 472 | 33.6 | 12.5 | **6,487** |

Compressor: ZPS20K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

## DX-25-HACW-P-1S — Cooling Mode — R410a 60 Hz

| Source Data (Indoor Loop) | | | | | | | | | Power Consumption | | | | | Sink Data (Outdoor Loop) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Suct. Pres. | Evap. Temp | EAT | Air Flow | LAT | Delta T | Latent | Sensible | HAB | Compressor | | Fan* | Total Electrical | Efficiency | Disch. Pres. | Cond. Temp. | Net Output |
| PSIG | °F | °F | CFM | °F | °F | BTU/Hr | BTU/Hr | BTU/Hr | Watts | Amps | Watts | Watts | EER | PSIG | °F | BTU/Hr |
| kPa | °C | °C | L/sec | °C | °C | Watts | Watts | Watts | | | | | COPc | kPa | °C | Watts |
| 143 | 50 | 80.0 | 1,000 | 62.8 | 17.2 | 7,352 | 18,221 | **25,574** | 1,099 | 4.7 | 110 | 1,209 | **21.1** | 237 | 80 | 29,701 |
| 987 | 10.0 | 26.7 | 472 | 17.1 | 9.5 | 2,154 | 5,339 | **7,493** | | | | | **6.20** | 1,631 | 26.7 | 8,702 |
| 143 | 50 | 80.0 | 1,000 | 63.3 | 16.7 | 7,164 | 17,753 | **24,917** | 1,185 | 5.1 | 110 | 1,295 | **19.2** | 255 | 85 | 29,338 |
| 987 | 10.0 | 26.7 | 472 | 17.4 | 9.3 | 2,099 | 5,202 | **7,300** | | | | | **5.64** | 1,761 | 29.4 | 8,596 |
| 143 | 50 | 80.0 | 1,000 | 63.7 | 16.3 | 6,971 | 17,277 | **24,249** | 1,274 | 5.4 | 110 | 1,384 | **17.5** | 275 | 90 | 28,973 |
| 987 | 10.0 | 26.7 | 472 | 17.6 | 9.0 | 2,043 | 5,062 | **7,105** | | | | | **5.13** | 1,899 | 32.2 | 8,489 |
| 143 | 50 | 80.0 | 1,000 | 64.2 | 15.8 | 6,776 | 16,793 | **23,569** | 1,367 | 5.8 | 110 | 1,477 | **16.0** | 296 | 95 | 28,609 |
| 987 | 10.0 | 26.7 | 472 | 17.9 | 8.8 | 1,985 | 4,920 | **6,906** | | | | | **4.68** | 2,044 | 35.0 | 8,382 |
| 143 | 51 | 80.0 | 1,000 | 64.5 | 15.5 | 6,639 | 16,453 | **23,092** | 1,463 | 6.2 | 110 | 1,573 | **14.7** | 319 | 100 | 28,462 |
| 987 | 10.3 | 26.7 | 472 | 18.1 | 8.6 | 1,945 | 4,821 | **6,766** | | | | | **4.30** | 2,196 | 37.8 | 8,339 |
| 143 | 51 | 80.0 | 1,000 | 65.0 | 15.0 | 6,435 | 15,948 | **22,383** | 1,565 | 6.6 | 110 | 1,675 | **13.4** | 342 | 105 | 28,100 |
| 987 | 10.3 | 26.7 | 472 | 18.3 | 8.3 | 1,885 | 4,673 | **6,558** | | | | | **3.91** | 2,357 | 40.6 | 8,233 |
| 143 | 51 | 80.0 | 1,000 | 65.5 | 14.5 | 6,227 | 15,433 | **21,661** | 1,673 | 7.1 | 110 | 1,783 | **12.2** | 366 | 110 | 27,745 |
| 987 | 10.3 | 26.7 | 472 | 18.6 | 8.1 | 1,825 | 4,522 | **6,347** | | | | | **3.56** | 2,526 | 43.3 | 8,129 |
| 143 | 51 | 80.0 | 1,000 | 66.0 | 14.0 | 6,016 | 14,909 | **20,925** | 1,787 | 7.6 | 110 | 1,897 | **11.0** | 392 | 115 | 27,400 |
| 987 | 10.3 | 26.7 | 472 | 18.9 | 7.8 | 1,763 | 4,368 | **6,131** | | | | | **3.23** | 2,705 | 46.1 | 8,028 |

Compressor: ZPS20K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

# CAPACITY RATINGS (continued)

## DX-45-HACW-P-1S — Heating Mode (Nominal 3 ton) — R410a 60 Hz

| Source Data (Outdoor Loop) | | | Power Consumption | | | | | Sink Data (Indoor Loop) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Suction Pressure | Evap. Temp | HAB | Compressor | | Fan* | Total Electrical | COPh | Discharge Pressure | Cond. Temp. | EAT | Air Flow | LAT | Delta T | Net Output |
| PSIG | °F | BTU/Hr | Watts | Amps | Watts | Watts | W/W | PSIG | °F | °F | CFM | °F | °F | BTU/Hr |
| kPa | °C | Watts | | | | | | kPa | °C | °C | L/sec | °C | °C | Watts |
| 62 | 10 | 17,610 | 1,939 | 8.5 | 180 | 2,119 | **3.44** | 305 | 97 | 70.0 | 1,400 | 86.7 | 16.7 | **24,840** |
| 430 | -12.2 | 5,160 | | | | | | 2104 | 36.1 | 21.1 | 661 | 30.4 | 9.3 | **7,278** |
| 70 | 15 | 19,204 | 1,996 | 8.7 | 180 | 2,176 | **3.59** | 314 | 99 | 70.0 | 1,400 | 87.9 | 17.9 | **26,630** |
| 484 | -9.4 | 5,627 | | | | | | 2165 | 37.2 | 21.1 | 661 | 31.1 | 10.0 | **7,803** |
| 79 | 20 | 20,790 | 2,080 | 9.1 | 180 | 2,260 | **3.70** | 328 | 102 | 70.0 | 1,400 | 89.2 | 19.2 | **28,502** |
| 543 | -6.7 | 6,092 | | | | | | 2259 | 38.9 | 21.1 | 661 | 31.8 | 10.7 | **8,351** |
| 88 | 25 | 22,475 | 2,165 | 9.5 | 180 | 2,345 | **3.81** | 342 | 105 | 70.0 | 1,400 | 90.5 | 20.5 | **30,479** |
| 605 | -3.9 | 6,585 | | | | | | 2357 | 40.6 | 21.1 | 661 | 32.5 | 11.4 | **8,930** |
| 97 | 30 | 25,716 | 2,220 | 9.8 | 180 | 2,400 | **4.14** | 352 | 107 | 70.0 | 1,400 | 92.8 | 22.8 | **33,907** |
| 672 | -1.1 | 7,535 | | | | | | 2424 | 41.7 | 21.1 | 661 | 33.8 | 12.7 | **9,935** |
| 108 | 35 | 27,900 | 2,280 | 10.0 | 180 | 2,460 | **4.32** | 361 | 109 | 70.0 | 1,400 | 94.4 | 24.4 | **36,297** |
| 743 | 1.7 | 8,175 | | | | | | 2492 | 42.8 | 21.1 | 661 | 34.7 | 13.6 | **10,635** |
| 119 | 40 | 30,025 | 2,372 | 10.5 | 180 | 2,552 | **4.45** | 377 | 112 | 70.0 | 1,400 | 96.1 | 26.1 | **38,733** |
| 819 | 4.4 | 8,797 | | | | | | 2597 | 44.4 | 21.1 | 661 | 35.6 | 14.5 | **11,349** |
| 131 | 45 | 32,256 | 2,467 | 10.9 | 180 | 2,647 | **4.57** | 392 | 115 | 70.0 | 1,400 | 97.8 | 27.8 | **41,289** |
| 900 | 7.2 | 9,451 | | | | | | 2705 | 46.1 | 21.1 | 661 | 36.5 | 15.4 | **12,098** |

Compressor: ZPS30K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

## DX-45-HACW-P-1S — Cooling Mode — R410a 60 Hz

| Source Data (Indoor Loop) | | | | | | | | | Power Consumption | | | | | Sink Data (Outdoor Loop) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Suct. Pres. | Evap. Temp | EAT | Air Flow | LAT | Delta T | Latent | Sensible | HAB | Compressor | | Fan* | Total Electrical | Efficiency | Disch. Pres. | Cond. Temp. | Net Output |
| PSIG | °F | °F | CFM | °F | °F | BTU/Hr | BTU/Hr | BTU/Hr | Watts | Amps | Watts | Watts | EER | PSIG | °F | BTU/Hr |
| kPa | °C | °C | L/sec | °C | °C | Watts | Watts | Watts | | | | | COPc | kPa | °C | Watts |
| 141 | 49.5 | 80.0 | 1,400 | 61.7 | 18.3 | 15,075 | 31,525 | **46,600** | 1,650 | 7.0 | 190 | 1,840 | **25.3** | 237 | 80 | 52,879 |
| 969 | 9.7 | 26.7 | 661 | 16.5 | 10.2 | 4,417 | 9,237 | **13,654** | | | | | **7.42** | 1,631 | 26.7 | 15,493 |
| 141 | 49.5 | 80.0 | 1,400 | 62.2 | 17.8 | 14,703 | 30,748 | **45,451** | 1,771 | 7.4 | 190 | 1,961 | **23.2** | 255 | 85 | 52,143 |
| 969 | 9.7 | 26.7 | 661 | 16.8 | 9.9 | 4,308 | 9,009 | **13,317** | | | | | **6.79** | 1,761 | 29.4 | 15,278 |
| 141 | 49.5 | 80.0 | 1,400 | 62.6 | 17.4 | 14,326 | 29,958 | **44,284** | 1,895 | 7.9 | 190 | 2,085 | **21.2** | 275 | 90 | 51,401 |
| 969 | 9.7 | 26.7 | 661 | 17.0 | 9.7 | 4,197 | 8,778 | **12,975** | | | | | **6.22** | 1,899 | 32.2 | 15,060 |
| 143 | 50 | 80.0 | 1,400 | 62.9 | 17.1 | 14,066 | 29,414 | **43,480** | 2,026 | 8.5 | 190 | 2,216 | **19.6** | 296 | 95 | 51,042 |
| 987 | 10.0 | 26.7 | 661 | 17.2 | 9.5 | 4,121 | 8,618 | **12,739** | | | | | **5.75** | 2,044 | 35.0 | 14,955 |
| 143 | 50 | 80.0 | 1,400 | 62.4 | 17.6 | 12,580 | 29,006 | **41,586** | 2,118 | 9.0 | 190 | 2,308 | **18.0** | 319 | 100 | 49,465 |
| 987 | 10.0 | 26.7 | 661 | 16.9 | 9.8 | 3,686 | 8,499 | **12,185** | | | | | **5.28** | 2,196 | 37.8 | 14,493 |
| 143 | 50 | 80.0 | 1,400 | 62.9 | 17.1 | 12,211 | 28,155 | **40,366** | 2,259 | 9.6 | 190 | 2,449 | **16.5** | 342 | 105 | 48,723 |
| 987 | 10.0 | 26.7 | 661 | 17.2 | 9.5 | 3,578 | 8,249 | **11,827** | | | | | **4.83** | 2,357 | 40.6 | 14,276 |
| 143 | 51 | 80.0 | 1,400 | 63.5 | 16.5 | 11,787 | 27,179 | **38,966** | 2,469 | 10.5 | 190 | 2,659 | **14.7** | 377 | 112 | 48,042 |
| 987 | 10.3 | 26.7 | 661 | 17.5 | 9.2 | 3,454 | 7,963 | **11,417** | | | | | **4.29** | 2,597 | 44.4 | 14,076 |
| 143 | 51 | 80.0 | 1,400 | 63.8 | 16.2 | 11,555 | 26,643 | **38,198** | 2,565 | 10.9 | 190 | 2,755 | **13.9** | 392 | 115 | 47,599 |
| 987 | 10.3 | 26.7 | 661 | 17.7 | 9.0 | 3,386 | 7,806 | **11,192** | | | | | **4.06** | 2,705 | 46.1 | 13,947 |

Compressor: ZPS30K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

# CAPACITY RATINGS (continued)

## DX-55-HACW-P-1S — Heating Mode (Nominal 4 ton) — R410a 60 Hz

| Source Data (Outdoor Loop) | | | Power Consumption | | | | | Sink Data (Indoor Loop) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Suction Pressure | Evap. Temp | HAB | Compressor | | Fan* | Total Electrical | COPh | Discharge Pressure | Cond. Temp. | EAT | Air Flow | LAT | Delta T | Net Output |
| PSIG | °F | BTU/Hr | Watts | Amps | Watts | Watts | W/W | PSIG | °F | °F | CFM | °F | °F | BTU/Hr |
| kPa | °C | Watts | | | | | | kPa | °C | °C | L/sec | °C | °C | Watts |
| 62 | 10 | 19,476 | 2,740 | 12.0 | 335 | 3,075 | **2.86** | 319 | 100 | 70.0 | 1,700 | 88.1 | 18.1 | **29,971** |
| 430 | -12.2 | 5,707 | | | | | | 2196 | 37.8 | 21.1 | 802 | 31.2 | 10.0 | **8,781** |
| 70 | 15 | 21,698 | 2,813 | 12.4 | 335 | 3,148 | **3.02** | 328 | 102 | 70.0 | 1,700 | 89.6 | 19.6 | **32,441** |
| 484 | -9.4 | 6,357 | | | | | | 2259 | 38.9 | 21.1 | 802 | 32.0 | 10.9 | **9,505** |
| 79 | 20 | 24,093 | 2,885 | 12.7 | 335 | 3,220 | **3.19** | 337 | 104 | 70.0 | 1,700 | 91.2 | 21.2 | **35,083** |
| 543 | -6.7 | 7,059 | | | | | | 2324 | 40.0 | 21.1 | 802 | 32.9 | 11.8 | **10,279** |
| 88 | 25 | 26,667 | 2,957 | 13.0 | 335 | 3,292 | **3.37** | 347 | 106 | 70.0 | 1,700 | 92.9 | 22.9 | **37,904** |
| 605 | -3.9 | 7,813 | | | | | | 2390 | 41.1 | 21.1 | 802 | 33.8 | 12.7 | **11,106** |
| 97 | 30 | 30,965 | 3,072 | 13.4 | 335 | 3,407 | **3.66** | 357 | 108 | 70.0 | 1,700 | 95.7 | 25.7 | **42,594** |
| 672 | -1.1 | 9,073 | | | | | | 2458 | 42.2 | 21.1 | 802 | 35.4 | 14.3 | **12,480** |
| 108 | 35 | 34,068 | 3,147 | 13.7 | 335 | 3,482 | **3.87** | 366 | 110 | 70.0 | 1,700 | 97.7 | 27.7 | **45,951** |
| 743 | 1.7 | 9,982 | | | | | | 2526 | 43.3 | 21.1 | 802 | 36.5 | 15.4 | **13,464** |
| 119 | 40 | 37,377 | 3,223 | 14.1 | 335 | 3,558 | **4.08** | 377 | 112 | 70.0 | 1,700 | 99.9 | 29.9 | **49,519** |
| 819 | 4.4 | 10,951 | | | | | | 2597 | 44.4 | 21.1 | 802 | 37.7 | 16.6 | **14,509** |
| 131 | 45 | 40,897 | 3,300 | 14.4 | 335 | 3,635 | **4.30** | 387 | 114 | 70.0 | 1,700 | 102.2 | 32.2 | **53,304** |
| 900 | 7.2 | 11,983 | | | | | | 2668 | 45.6 | 21.1 | 802 | 39.0 | 17.9 | **15,618** |

Compressor: ZPS40K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

## DX-55-HACW-P-1S — Cooling Mode — R410a 60 Hz

| Source Data (Indoor Loop) | | | | | | | | | Power Consumption | | | | | Sink Data (Outdoor Loop) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Suct. Pres. | Evap. Temp | EAT | Air Flow | LAT | Delta T | Latent | Sensible | HAB | Compressor | | Fan* | Total Electrical | Efficiency | Disch. Pres. | Cond. Temp. | Net Output |
| PSIG | °F | °F | CFM | °F | °F | BTU/Hr | BTU/Hr | BTU/Hr | Watts | Amps | Watts | Watts | EER | PSIG | °F | BTU/Hr |
| kPa | °C | °C | L/sec | °C | °C | Watts | Watts | Watts | | | | | COPc | kPa | °C | Watts |
| 136 | 47 | 80.0 | 1,700 | 61.2 | 18.8 | 16,828 | 36,807 | **53,635** | 2,297 | 9.8 | 365 | 2,662 | **20.1** | 237 | 80 | 62,721 |
| 934 | 8.3 | 26.7 | 802 | 16.2 | 10.4 | 4,931 | 10,784 | **15,715** | | | | | **5.90** | 1,631 | 26.7 | 18,377 |
| 136 | 47 | 80.0 | 1,700 | 61.7 | 18.3 | 16,422 | 35,919 | **52,340** | 2,447 | 10.4 | 365 | 2,812 | **18.6** | 255 | 85 | 61,937 |
| 934 | 8.3 | 26.7 | 802 | 16.5 | 10.2 | 4,812 | 10,524 | **15,336** | | | | | **5.45** | 1,761 | 29.4 | 18,147 |
| 136 | 47.5 | 80.0 | 1,700 | 62.0 | 18.0 | 16,163 | 35,353 | **51,516** | 2,601 | 11.0 | 365 | 2,966 | **17.4** | 275 | 90 | 61,638 |
| 934 | 8.6 | 26.7 | 802 | 16.6 | 10.0 | 4,736 | 10,358 | **15,094** | | | | | **5.09** | 1,899 | 32.2 | 18,060 |
| 138 | 48 | 80.0 | 1,700 | 62.3 | 17.7 | 15,887 | 34,749 | **50,636** | 2,760 | 11.7 | 365 | 3,125 | **16.2** | 296 | 95 | 61,302 |
| 951 | 8.9 | 26.7 | 802 | 16.8 | 9.9 | 4,655 | 10,181 | **14,836** | | | | | **4.75** | 2,044 | 35.0 | 17,961 |
| 138 | 48 | 80.0 | 1,700 | 62.6 | 17.4 | 13,966 | 33,377 | **47,343** | 2,889 | 12.3 | 365 | 3,254 | **14.6** | 319 | 100 | 58,448 |
| 951 | 8.9 | 26.7 | 802 | 17.0 | 9.7 | 4,092 | 9,779 | **13,871** | | | | | **4.26** | 2,196 | 37.8 | 17,125 |
| 138 | 49 | 80.0 | 1,700 | 62.9 | 17.1 | 13,686 | 32,707 | **46,393** | 3,059 | 13.1 | 365 | 3,424 | **13.5** | 342 | 105 | 58,080 |
| 951 | 9.2 | 26.7 | 802 | 17.2 | 9.5 | 4,010 | 9,583 | **13,593** | | | | | **3.97** | 2,357 | 40.6 | 17,017 |
| 141 | 49 | 80.0 | 1,700 | 63.3 | 16.7 | 13,389 | 31,996 | **45,385** | 3,238 | 13.8 | 365 | 3,603 | **12.6** | 366 | 110 | 57,684 |
| 969 | 9.4 | 26.7 | 802 | 17.4 | 9.3 | 3,923 | 9,375 | **13,298** | | | | | **3.69** | 2,526 | 43.3 | 16,901 |
| 141 | 49 | 80.0 | 1,700 | 63.9 | 16.1 | 12,943 | 30,931 | **43,874** | 3,427 | 14.6 | 365 | 3,792 | **11.6** | 392 | 115 | 56,816 |
| 969 | 9.4 | 26.7 | 802 | 17.7 | 9.0 | 3,792 | 9,063 | **12,855** | | | | | **3.39** | 2,705 | 46.1 | 16,647 |

Compressor: ZPS40K4E-PFV

* @ 37.3Pa (0.15inH2o) Ext. Static

# CAPACITY RATINGS (continued)

## DX-65-HACW-P-1S — Heating Mode (Nominal 5 ton) — R410a 60 Hz

| Source Data (Outdoor Loop) | | | Power Consumption | | | | | Sink Data (Indoor Loop) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Suction Pressure | Evap. Temp | HAB | Compressor | | Fan* | Total Electrical | COPh | Discharge Pressure | Cond. Temp. | EAT | Air Flow | LAT | Delta T | Net Output |
| PSIG | °F | BTU/Hr | Watts | Amps | Watts | Watts | W/W | PSIG | °F | °F | CFM | °F | °F | BTU/Hr |
| kPa | °C | Watts | | | | | | kPa | °C | °C | L/sec | °C | °C | Watts |
| 62 | 10 | 27,054 | 3,384 | 14.7 | 455 | 3,839 | **3.06** | 301 | 96 | 70.0 | 2,100 | 88.0 | 18.0 | **40,155** |
| 430 | -12.2 | 7,927 | | | | | | 2073 | 35.6 | 21.1 | 991 | 31.1 | 10.0 | **11,765** |
| 70 | 15 | 29,807 | 3,484 | 15.1 | 455 | 3,939 | **3.22** | 310 | 98 | 70.0 | 2,100 | 89.4 | 19.4 | **43,251** |
| 484 | -9.4 | 8,733 | | | | | | 2134 | 36.7 | 21.1 | 991 | 31.9 | 10.8 | **12,672** |
| 79 | 20 | 32,777 | 3,584 | 15.5 | 455 | 4,039 | **3.38** | 319 | 100 | 70.0 | 2,100 | 90.9 | 20.9 | **46,560** |
| 543 | -6.7 | 9,603 | | | | | | 2196 | 37.8 | 21.1 | 991 | 32.7 | 11.6 | **13,642** |
| 88 | 25 | 35,969 | 3,683 | 15.9 | 455 | 4,138 | **3.55** | 328 | 102 | 70.0 | 2,100 | 92.5 | 22.5 | **50,092** |
| 605 | -3.9 | 10,539 | | | | | | 2259 | 38.9 | 21.1 | 991 | 33.6 | 12.5 | **14,677** |
| 97 | 30 | 39,930 | 3,712 | 16.3 | 455 | 4,167 | **3.81** | 337 | 104 | 70.0 | 2,100 | 95.3 | 25.3 | **54,151** |
| 672 | -1.1 | 11,699 | | | | | | 2324 | 40.0 | 21.1 | 991 | 35.2 | 14.1 | **15,866** |
| 108 | 35 | 43,638 | 3,811 | 16.7 | 455 | 4,266 | **4.00** | 347 | 106 | 70.0 | 2,100 | 97.2 | 27.2 | **58,198** |
| 743 | 1.7 | 12,786 | | | | | | 2390 | 41.1 | 21.1 | 991 | 36.2 | 15.1 | **17,052** |
| 119 | 40 | 47,592 | 3,912 | 17.2 | 455 | 4,367 | **4.19** | 357 | 108 | 70.0 | 2,100 | 99.2 | 29.2 | **62,498** |
| 819 | 4.4 | 13,944 | | | | | | 2458 | 42.2 | 21.1 | 991 | 37.4 | 16.2 | **18,312** |
| 131 | 45 | 51,799 | 4,016 | 17.6 | 455 | 4,471 | **4.39** | 366 | 110 | 70.0 | 2,100 | 101.4 | 31.4 | **67,060** |
| 900 | 7.2 | 15,177 | | | | | | 2526 | 43.3 | 21.1 | 991 | 38.5 | 17.4 | **19,649** |

Compressor: ZPS51K4E-PFV

* @ 49.7Pa (0.20inH2o) Ext. Static

## DX-65-HACW-P-1S — Cooling Mode — R410a 60 Hz

| Source Data (Indoor Loop) | | | | | | | | | Power Consumption | | | | | Sink Data (Outdoor Loop) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Suct. Pres. | Evap. Temp | EAT | Air Flow | LAT | Delta T | Latent | Sensible | HAB | Compressor | | Fan* | Total Electrical | Efficiency | Disch. Pres. | Cond. Temp. | Net Output |
| PSIG | °F | °F | CFM | °F | °F | BTU/Hr | BTU/Hr | BTU/Hr | Watts | Amps | Watts | Watts | EER | PSIG | °F | BTU/Hr |
| kPa | °C | °C | L/sec | °C | °C | Watts | Watts | Watts | | | | | COPc | kPa | °C | Watts |
| 131 | 45.5 | 80.0 | 2,100 | 63.0 | 17.0 | 21,714 | 43,372 | **65,086** | 2,843 | 12.4 | 515 | 3,358 | **19.4** | 237 | 80 | 76,548 |
| 900 | 7.5 | 26.7 | 991 | 17.2 | 9.4 | 6,362 | 12,708 | **19,070** | | | | | **5.68** | 1,631 | 26.7 | 22,428 |
| 133 | 46 | 80.0 | 2,100 | 63.3 | 16.7 | 21,412 | 42,767 | **64,179** | 3,055 | 13.2 | 515 | 3,570 | **18.0** | 255 | 85 | 76,364 |
| 917 | 7.8 | 26.7 | 991 | 17.4 | 9.3 | 6,274 | 12,531 | **18,804** | | | | | **5.27** | 1,761 | 29.4 | 22,375 |
| 133 | 46.5 | 80.0 | 2,100 | 63.5 | 16.5 | 21,088 | 42,121 | **63,208** | 3,273 | 14.0 | 515 | 3,788 | **16.7** | 275 | 90 | 76,137 |
| 917 | 8.1 | 26.7 | 991 | 17.5 | 9.2 | 6,179 | 12,341 | **18,520** | | | | | **4.89** | 1,899 | 32.2 | 22,308 |
| 136 | 47 | 80.0 | 2,100 | 63.8 | 16.2 | 20,743 | 41,431 | **62,174** | 3,498 | 14.8 | 515 | 4,013 | **15.5** | 296 | 95 | 75,869 |
| 934 | 8.3 | 26.7 | 991 | 17.7 | 9.0 | 6,078 | 12,139 | **18,217** | | | | | **4.54** | 2,044 | 35.0 | 22,229 |
| 136 | 48 | 80.0 | 2,100 | 62.7 | 17.3 | 18,024 | 42,307 | **60,331** | 3,663 | 15.7 | 515 | 4,178 | **14.4** | 319 | 100 | 74,592 |
| 934 | 8.6 | 26.7 | 991 | 17.1 | 9.6 | 5,281 | 12,396 | **17,677** | | | | | **4.23** | 2,196 | 37.8 | 21,855 |
| 138 | 48 | 80.0 | 2,100 | 63.0 | 17.0 | 17,678 | 41,496 | **59,174** | 3,903 | 16.7 | 515 | 4,418 | **13.4** | 342 | 105 | 74,254 |
| 951 | 8.9 | 26.7 | 991 | 17.2 | 9.4 | 5,180 | 12,158 | **17,338** | | | | | **3.92** | 2,357 | 40.6 | 21,756 |
| 138 | 49 | 80.0 | 2,100 | 63.4 | 16.6 | 17,312 | 40,635 | **57,947** | 4,155 | 17.6 | 515 | 4,670 | **12.4** | 366 | 110 | 73,886 |
| 951 | 9.2 | 26.7 | 991 | 17.4 | 9.2 | 5,072 | 11,906 | **16,978** | | | | | **3.64** | 2,526 | 43.3 | 21,648 |
| 141 | 49 | 80.0 | 2,100 | 63.8 | 16.2 | 16,923 | 39,724 | **56,647** | 4,421 | 18.7 | 515 | 4,936 | **11.5** | 392 | 115 | 73,493 |
| 969 | 9.4 | 26.7 | 991 | 17.6 | 9.0 | 4,958 | 11,639 | **16,597** | | | | | **3.36** | 2,705 | 46.1 | 21,533 |

Compressor: ZPS51K4E-PFV

* @ 49.7Pa (0.20inH2o) Ext. Static

| Table 16 - Heat Pump Electrical Information (230-1-60) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | Compressor | | Fan | FLA | MCA | Max Fuse/ Breaker | Wire Size** |
| | RLA | LRA | RLA | Amps | Amps | Amps | ga |
| 25 | 15.0 | 58 | 2.5 | 18.5 | 22.3 | 30 | #10-3 |
| 45 | 18.6 | 79 | 3.5 | 23.1 | 27.8 | 40 | #8-3 |
| 55 | 24.3 | 117 | 4.0 | 29.3 | 35.4 | 50 | #6-3 |
| 65 | 29.3 | 134 | 5.5 | 35.8 | 43.1 | 60 | #6-3 |

** H and HAC models may be connected with 2 conductor cable

| Table 17 - Heat Pump Electrical Information (208-3-60) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | Compressor | | Fan | FLA | MCA | Max Fuse/ Breaker | Wire Size** |
| | RLA | LRA | RLA | Amps | Amps | Amps | ga |
| 25 | 7.9 | 55 | 2.5 | 11.2 | 13.2 | 15 | #14-3 |
| 45 | 11.6 | 73 | 3.5 | 15.9 | 18.8 | 30 | #10-3 |
| 55 | 15.3 | 83 | 4.0 | 20.1 | 23.9 | 40 | #8-3 |
| 65 | 17.4 | 110 | 5.5 | 23.7 | 28.1 | 40 | #8-3 |
| 80 | 25.0 | 149 | 7.0 | 32.8 | 39.1 | 50 | #6-3 |

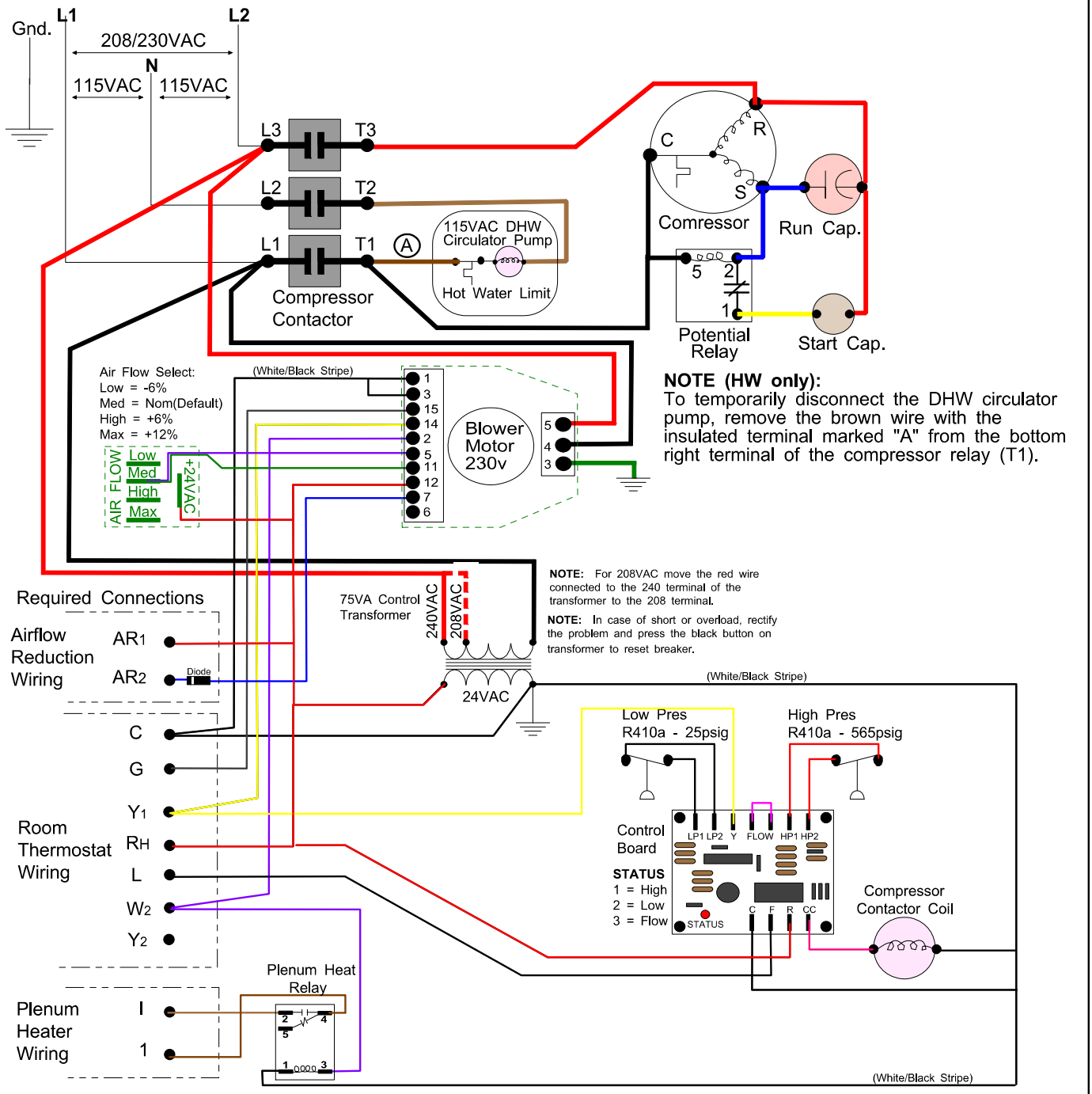
** H and HAC models may be connected with 3 conductor cable

| Table 18 - Heat Pump Electrical Information (220-1-50) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | Compressor | | Fan | FLA | MCA | Max Fuse/ Breaker | Wire Size |
| | RLA | LRA | RLA | Amps | Amps | Amps | ga |
| 25 | 10.0 | 52 | 2.5 | 13.5 | 16.0 | 25 | #10-2 |
| 45 | 15.0 | 67 | 3.5 | 19.5 | 23.3 | 30 | #10-2 |
| 55 | 17.7 | 98 | 4.0 | 22.7 | 27.1 | 40 | #8-2 |
| 65 | 22.5 | 153 | 5.5 | 29.0 | 34.6 | 50 | #6-2 |

| Table 19 - Heat Pump Electrical Information (380-3-50) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | Compressor | | Fan | FLA | MCA | Max Fuse/ Breaker | Wire Size** |
| | RLA | LRA | RLA | Amps | Amps | Amps | ga |
| 25 | 3.9 | 27 | 2.5 | 7.2 | 8.2 | 15 | #14-4 |
| 45 | 6.1 | 38 | 3.5 | 10.4 | 11.9 | 15 | #14-4 |
| 55 | 6.8 | 43 | 4.0 | 11.6 | 13.3 | 20 | #12-4 |
| 65 | 8.6 | 52 | 5.5 | 14.9 | 17.1 | 30 | #10-4 |

# DX-Series Schematic Diagram

*208/230-1-60 / Scroll / ECM Fan*




**PLENUM HEATER OPERATION**

- I & 1 provides a set of dry contacts for operating plenum heater.
- Fan will run automatically with Thermostat $W_2$ signal.

**AIRFLOW REDUCTION**

Connect $AR_1$ & $AR_2$ together with dry contacts to reduce the airflow for zone applications.

| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 01 | Initial Release | C. GEDDES | C. GEDDES | 27 SEP 11 |

| | | |
|---|---|---|
| Drawn By: Chris Geddes | | Date: 27 SEP 11 |
| Checked By: Chris Geddes | | Date: 27 SEP 11 |
| Approved By: Chris Geddes | (ENG) | Date: 27 SEP 11 |
| Approved By | (MFG) | Date |
| Approved By | | Date |

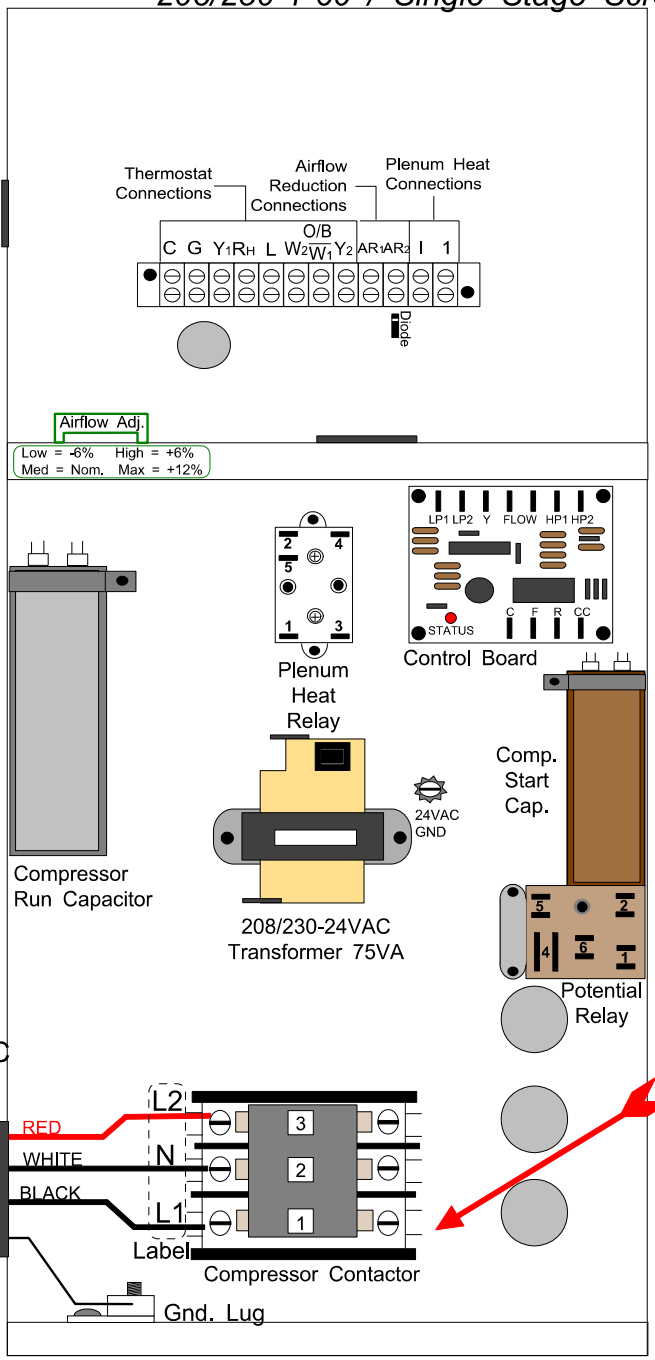
MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: DX-**-H*-P*-1S-*-*DE** Schematic Diagram

| Size | Drawing Number | REV | SHEET |
|---|---|---|---|
| A | 001563SCH | 01 | 1 of 1 |

# DX-Series Electrical Box Diagram

*208/230-1-60 / Single Stage Scroll / ECM Fan*




## Low Voltage Wiring (24VAC)

### Thermostat Wiring

Use an 18-6 conductor cable to connect this unit to the thermostat.

| | |
|---|---|
| C | - 24VAC Common |
| G | - Fan |
| $Y_1$ | - Stage 1 Heat/Cool (Compressor) |
| $R_H$ | - 24VAC Hot |
| L | - Trouble (if available on thermostat) |
| $W_2$ | - Stage 2 Heat (Plenum Heater) |
| $O/B/W_1$ | - Not Applicable |
| Y2 | - Not Applicable |

### Airflow Reduction Wiring

Use an 18-2 conductor cable to connect Electrical Box AR1 AR2 to dry contacts. Fan speed can be reduced by 15% for zone applications.

### Plenum Heater Wiring

Use an 18-2 conductor cable to connect Electrical Box I 1 to Plenum Heater C 1 (or I 1 )

### Domestic Hot water Circulator Pump Instructions (HACW):

**Note:** If heat pump is to be operated without the hot water circulator connected to the water tank and flooded with water, remove the brown wire with the insulated terminal located here. **This pump is water lubricated and must not be run dry.**

**IMPORTANT NOTE FOR 208-1-60 POWER**

Ensure red wire is connected to the 208 terminal on the transformer instead of the 230V terminal.

Heat Pump Electrical Service Requirements

208/230VAC Single Phase 60Hz (208/230-1-60)

| Model Size | Min. Circuit Ampacity | Min. Wire Gauge | TD Fuse or Breaker |
|---|---|---|---|
| 25 | 22 | 10-3 | 30 |
| 45 | 28 | 8-3 | 40 |
| 55 | 35 | 6-3 | 50 |
| 65 | 43 | 6-3 | 60 |
| 80 | 53 | 6-3 | 70 |

| 230/115VAC CONNECTIONS | | |
|---|---|---|
| **Wire** | **Colour** | **Contactor** |
| L2 | Red | L3 |
| N | White | L2 |
| L1 | Black | L1 |
| Connect "Gnd" to Gnd. Lug | | |

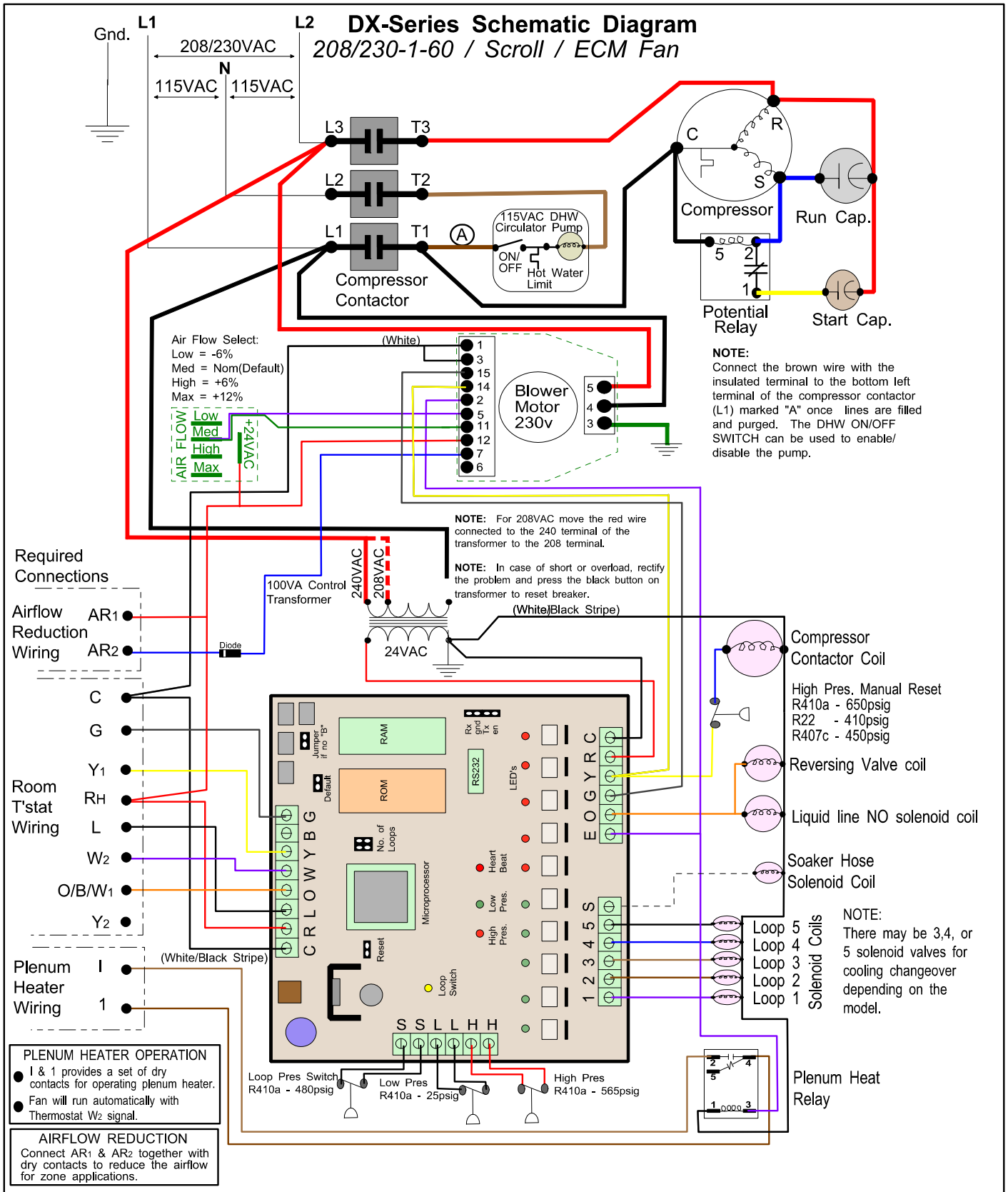
| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 01 | Initial Release | C. GEDDES | C. GEDDES | 27 SEP 11 |

| | | |
|---|---|---|
| Drawn By Chris Geddes | | Date 27 SEP 11 |
| Checked By Chris Geddes | | Date 27 SEP 11 |
| Approved By Chris Geddes | (ENG) | Date 27 SEP 11 |
| Approved By | (MFG) | Date |
| Approved By | | Date |

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: DX-**-H*-P*-1S-*-*DE**
Electrical Box Diagram

| Size | Drawing Number | REV | SHEET |
|---|---|---|---|
| A | 001564ELB | 01 | 1 of 1 |




| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 01 | Initial Release | C. GEDDES | C. GEDDES | 27 SEP 11 |

| | | |
|---|---|---|
| Drawn By | Chris Geddes | Date 27 SEP 11 |
| Checked By | Chris Geddes | Date 27 SEP 11 |
| Approved By (ENG) | Chris Geddes | Date 27 SEP 11 |
| Approved By (MFG) | | Date |
| Approved By | | Date |

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

Drawing Name: DX-**-HAC*-P*-1S-*-*DE** Schematic Diagram

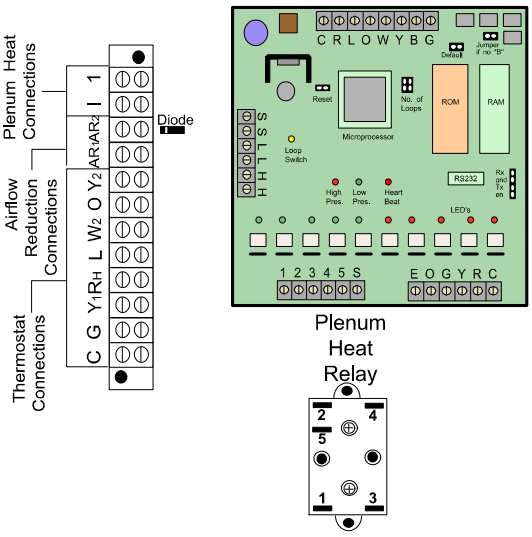
| Size | Drawing Number | REV | SHEET |
|---|---|---|---|
| A | 001561SCH | 01 | 1 of 1 |

# DX-Series Electrical Box Diagram

*208/230-1-60 / Single Stage Scroll / ECM Fan*

**AIRFLOW SELECT**
Low = -6%
High = +6%
Med = Nom.
Max = +12%

Field T'stat Wiring 24VAC




Airflow Adj.
Low = -6% High = +6%
Med = Nom. Max = +12%

208/240-24VAC
100VA Transformer

24VAC GND

Start Capacitor.

Capacitor

Field Wiring 208/ 230VAC 115VAC

L2
N
L1
Gnd

RED
WHITE
BLACK

Compressor Contactor
L2
L1
3
2
1

Label

Gnd. Lug

Potential Relay
5
2
4
6
1

## Low Voltage Wiring (24VAC)

### Thermostat Wiring

Use an 18-7 conductor cable to connect this unit to the thermostat.

- C - 24VAC Common
- G - Fan
- $Y_1$ - Stage 1 Heat/Cool (Compressor)
- $R_H$ - 24VAC Hot
- L - Trouble (if available on thermostat)
- $W_2$ - Stage 2 Heat (Plenum Heater)
- $O/B/W_1$ - Reversing Valve (Active in Cooling)
- Y2 - Not Applicable

### Airflow Reduction Wiring

Use an 18-2 conductor cable to connect Electrical Box AR1 AR2 to dry contacts. Fan speed can be reduced by 15% for zone applications.

### Plenum Heater Wiring

Use an 18-2 conductor cable to connect Electrical Box I 1 to Plenum Heater C 1 (or I 1 )

### Domestic Hot Water Circulator Pump Instructions:

If heat pump is to be operated without the hot water circulator connected to the water tank and flooded with water, remove the brown wire with the insulated terminal located here. **This pump is water lubricated and must not be run dry.** Once connected the external ON/OFF switch may be used to temporarily turn the pump off.

**IMPORTANT NOTE FOR 208-1-60 POWER**

Ensure red wire is connected to the 208 terminal on the transformer instead of the 230V terminal.

Heat Pump Electrical Service Requirements
208/230VAC Single Phase 60Hz (208/230-1-60)

| Model Size | Min. Circuit Ampacity | Min. Wire Gauge | TD Fuse or Breaker |
|---|---|---|---|
| 25 | 22 | 10-3 | 30 |
| 45 | 28 | 8-3 | 40 |
| 55 | 35 | 6-3 | 50 |
| 65 | 43 | 6-3 | 60 |
| 80 | 53 | 6-3 | 70 |

| 230/115VAC CONNECTIONS | | |
|---|---|---|
| **Wire** | **Colour** | **Contactor** |
| L2 | Red | L3 |
| N | White | L2 |
| L1 | Black | L1 |
| Connect "Gnd" to Gnd. Lug | | |

| REV | ECO # | IMPL BY | APVD BY | DATE |
|---|---|---|---|---|
| 02 | 000194 | C. GEDDES | C. GEDDES | 01 NOV 11 |
| 01 | Initial Release | C. GEDDES | C. GEDDES | 27 SEP 11 |

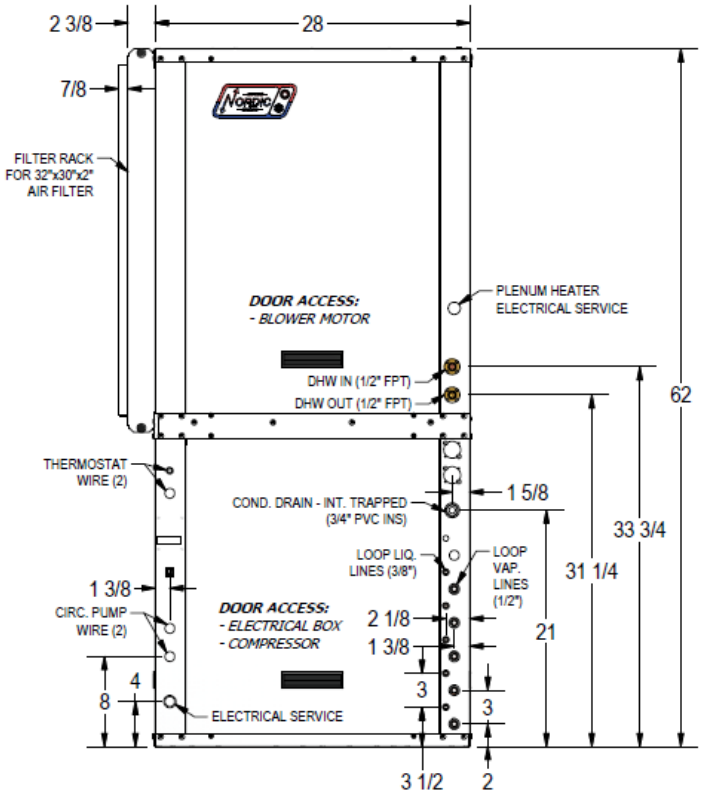
| | | |
|---|---|---|
| Drawn By Chris Geddes | | Date 27 SEP 11 |
| Checked By Chris Geddes | | Date 27 SEP 11 |
| Approved By Chris Geddes | (ENG) | Date 27 SEP 11 |
| Approved By | (MFG) | Date |
| Approved By | | Date |

MARITIME GEOTHERMAL LTD.
170 Plantation Rd.
Petitcodiac, NB
E4Z 6H4

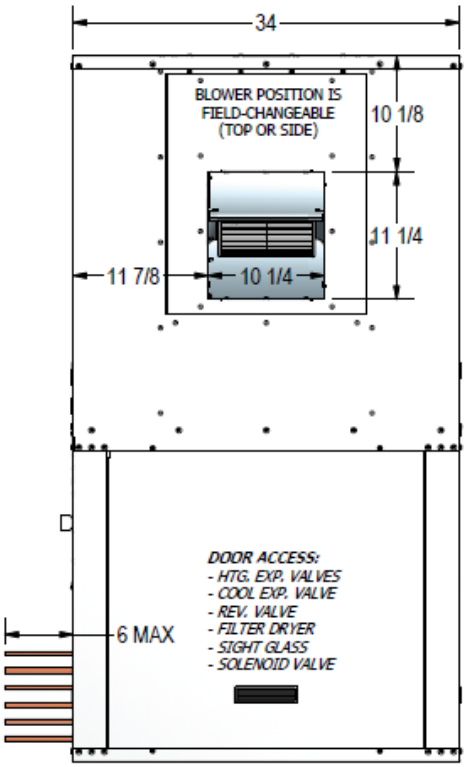
Drawing Name: DX-**-HAC*-P*-1S-*-*DE**
Electrical Box Diagram

| Size | Drawing Number | REV | SHEET |
|---|---|---|---|
| A | 001562ELB | 02 | 1 of 1 |

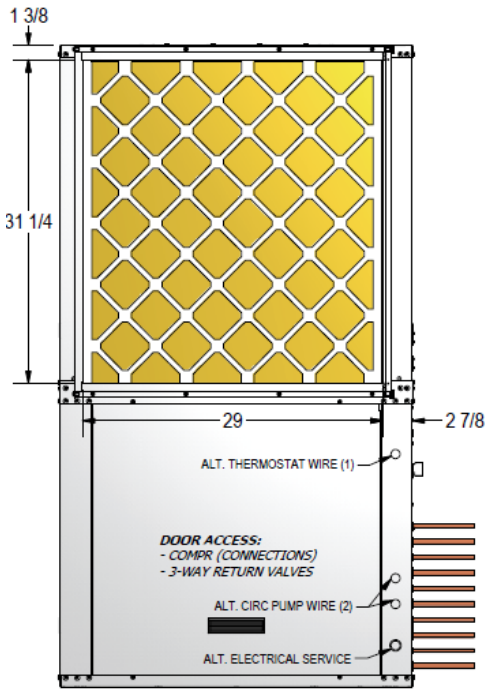
# CASE DETAILS



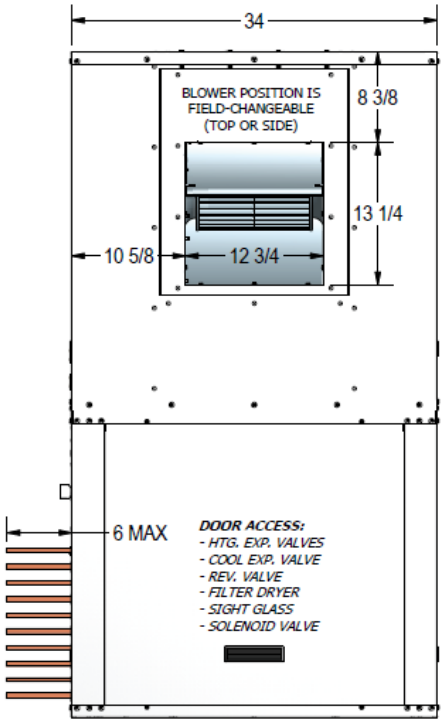

***Front View***



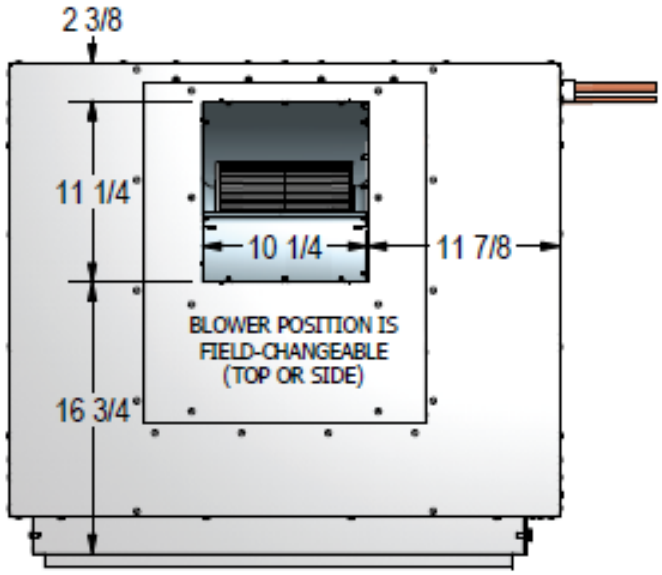

***Right Side View (25-45)***



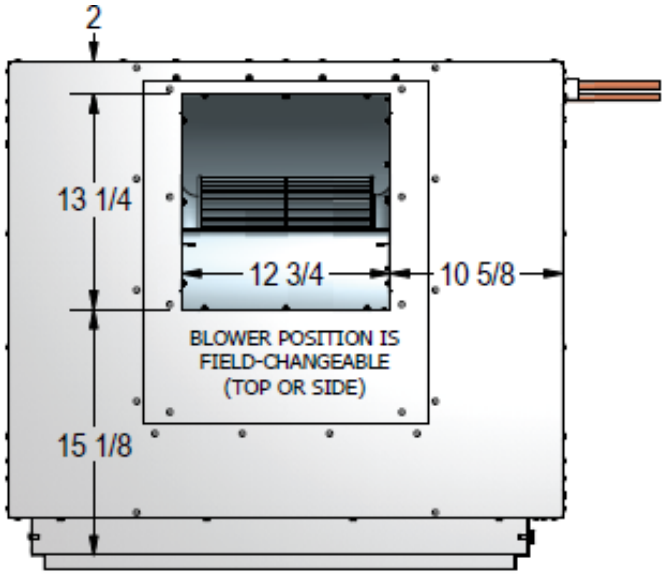

***Left Side View***




***Right Side View (55-65)***




***Top View (Size 25-45)***




***Top View (Size 55-80)***

# APPENDIX A - ECM Fan Airflow Tables

| NOMINAL AIRFLOW SETTING (MED) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | STAGE 1 | | | | FAN ONLY (Recirculation) | | | |
| Model | Full | | Reduced* | | Full | | Reduced* | |
| | CFM | L/s | CFM | L/s | CFM | L/s | CFM | L/s |
| 25 | 800 | 378 | 680 | 321 | 448 | 211 | 381 | 180 |
| 45 | 1200 | 566 | 1020 | 481 | 672 | 317 | 571 | 270 |
| 55 | 1500 | 708 | 1275 | 602 | 840 | 396 | 714 | 337 |
| 65 | 1900 | 897 | 1615 | 762 | 1064 | 502 | 904 | 427 |
| 80 | 2400 | 1133 | 2040 | 963 | 1344 | 634 | 1142 | 539 |

| -6% AIRFLOW SETTING (LOW) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | STAGE 1 | | | | FAN ONLY (Recirculation) | | | |
| Model | Full | | Reduced* | | Full | | Reduced* | |
| | CFM | L/s | CFM | L/s | CFM | L/s | CFM | L/s |
| 25 | 752 | 355 | 639 | 302 | 421 | 199 | 358 | 169 |
| 45 | 1128 | 532 | 959 | 453 | 632 | 298 | 537 | 253 |
| 55 | 1410 | 665 | 1199 | 566 | 790 | 373 | 671 | 317 |
| 65 | 1786 | 843 | 1518 | 716 | 1000 | 472 | 850 | 401 |
| 80 | 2256 | 1065 | 1918 | 905 | 1263 | 596 | 1074 | 507 |

| +6% AIRFLOW SETTING (HIGH) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | STAGE 1 | | | | FAN ONLY (Recirculation) | | | |
| Model | Full | | Reduced* | | Full | | Reduced* | |
| | CFM | L/s | CFM | L/s | CFM | L/s | CFM | L/s |
| 25 | 848 | 400 | 721 | 340 | 475 | 224 | 404 | 191 |
| 45 | 1272 | 600 | 1081 | 510 | 712 | 336 | 605 | 286 |
| 55 | 1590 | 750 | 1352 | 638 | 890 | 420 | 757 | 357 |
| 65 | 2014 | 951 | 1712 | 808 | 1128 | 532 | 959 | 452 |
| 80 | 2544 | 1201 | 2162 | 1021 | 1425 | 672 | 1211 | 572 |

| +12% AIRFLOW SETTING (MAX) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | STAGE 1 | | | | FAN ONLY (Recirculation) | | | |
| Model | Full | | Reduced* | | Full | | Reduced* | |
| | CFM | L/s | CFM | L/s | CFM | L/s | CFM | L/s |
| 25 | 896 | 423 | 762 | 359 | 502 | 237 | 426 | 201 |
| 45 | 1344 | 634 | 1142 | 539 | 753 | 355 | 640 | 302 |
| 55 | 1680 | 793 | 1428 | 674 | 941 | 444 | 800 | 377 |
| 65 | 2128 | 1004 | 1809 | 854 | 1192 | 562 | 1013 | 478 |
| 80 | 2688 | 1269 | 2285 | 1078 | 1505 | 710 | 1279 | 604 |

NOTES: Unit sizes 25, 45 and 55 nominal value up to 0.50 inH2o, sizes 65 and 80 up to 0.70inH2o
*To obtain the REDUCED airflow values use a dry contact to connect AR1 to AR2 on the terminal strip

**INFORMATION TAKEN FROM DOCUMENT 000527INF-04**

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# LIMITED EXPRESS WARRANTY

It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Maritime Geothermal Ltd., a corporation registered in New Brunswick, Canada, ("MG") or its representatives, relating to MG's products, whether oral, written or contained in any sales literature, catalogue or agreement, are not express warranties and do not form a part of the basis of the bargain, but are merely MG's opinion or commendation of MG's products.
**EXCEPT AS SPECIFICALLY SET FORTH HEREIN, THERE IS NO EXPRESS WARRANTY AS TO ANY OF MG'S PRODUCTS. MG MAKES NO WARRANTY AGAINST LATENT DEFECTS. MG MAKES NO WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.**

**LIMITED EXPRESS RESIDENTIAL WARRANTY - PARTS**
MG warrants its Residential Class products, purchased and retained in the United States of America and Canada, to be free from defects in material and workmanship under normal use and maintenance as follows:
(1) Air conditioning, heating and/or heat pump units built or sold by MG ("MG Units") for five (5) years from the Warranty Inception Date (as defined below).
(2) Thermostats, auxiliary electric heaters and geothermal pumping modules built or sold by MG, when installed with MG Units, for five (5) years from the Warranty Inception Date (as defined below).
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for ten (10) years from the Warranty Inception Date (as defined below).
(4) Other accessories and parts built or sold by MG, when installed and purchased with MG Units, for five (5) years from the date of shipment from MG.
(5) Other accessories, when purchased separately, for (1) year from the date of shipment from MG.

**The "Warranty Inception Date" shall be the date of original unit installation, as per the date on the installation Startup Record or six (6) months from date of unit shipment from MG, whichever comes first.**

To make a claim under this warranty, parts must be returned to MG in Petitcodiac, New Brunswick, freight prepaid, no later than ninety (90) days after the date of the failure of the part. If MG determines the part to be defective and within MG's Limited Express Residential Warranty, MG shall, when such part has been either replaced or repaired, return such to a factory recognized distributor, dealer or service organization, freight prepaid. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

**LIMITED EXPRESS RESIDENTIAL WARRANTY - LABOUR**
This Limited Express Residential Labour Warranty shall cover the **labour** incurred by MG authorized service personnel in connection with the installation of a new or repaired warranty part that is covered by this Limited Express Residential Warranty only to the extent specifically set forth in the current **labour** allowance schedule "A" provided by MG's Warranty Department and only as follows:
(1) MG Units for two (2) years from the Warranty Inception Date.
(2) Thermostats, auxiliary electric heaters and geothermal pump modules built or sold by MG, when installed with MG Units, for two (2) years from the Warranty Inception Date.
(3) Sealed refrigerant circuit components of MG Units (which components only include the compressor, refrigerant to air/water heat exchangers, reversing valve body and refrigerant metering device) for five (5) years from the Warranty Inception Date.

**Labour** costs are not covered by this Limited Express Residential Warranty to the extent they **exceed** the amount allowed under said allowance schedule, they are not specifically provided for in said allowance schedule, they are not the result of work performed by MG authorized service personnel, they are incurred in connection with a part not covered by this Limited Express Residential Warranty, or they are incurred more than the time periods set forth in this paragraph after the Warranty Inception Date.
This warranty does not cover and does not apply to:
(1) Air filters, fuses, refrigerant, fluids, oil.
(2) Products relocated after initial installation.
(3) Any portion or component of any system that is not supplied by MG, regardless of the cause of the failure of such portion or component.
(4) Products on which the unit identification tags or labels have been removed or defaced.
(5) Products on which payment to MG, or to the owner's seller or installing contractor, is in default.
(6) Products subjected to improper or inadequate installation, maintenance, repair, wiring or voltage conditions.
(7) Products subjected to accident, misuse, negligence, abuse, fire, flood, lightning, unauthorized alteration, misapplication, contaminated or corrosive liquid or air supply, operation at abnormal air or liquid temperatures or flow rates, or opening of the refrigerant circuit by unqualified personnel.
(8) Mold, fungus or bacteria damage
(9) Corrosion or abrasion of the product.
(10) Products supplied by others.
(11) Products which have been operated in a manner contrary to MG's printed instructions.
(12) Products which have insufficient performance as a result of improper system design or improper application, installation, or use of MG's products.
(13) Electricity or fuel, or any increases or unrealized savings in same, for any reason whatsoever.

Except for the limited **labour** allowance coverage set forth above, MG is not responsible for:
(1) The costs of fluids, refrigerant or system components **supplied by others**, or associated **labour** to repair or replace the same, which is incurred as a result of a defective part covered by MG's Limited Residential Warranty.
(2) The costs of **labour**, refrigerant, materials or service incurred in diagnosis and removal of the defective part, or in obtaining and replacing the new or repaired part.
(3) Transportation costs of the defective part from the installation site to MG, or of the return of that part if not covered by MG's Limited Express Residential Warranty.
(4) The costs of normal maintenance.

This Limited Express Residential Warranty applies to MG Residential Class products manufactured on or after February 15, 2010. MG'S LIABILITY UNDER THE TERMS OF THIS LIMITED WARRANTY SHALL APPLY ONLY TO THE MG UNITS REGISTERED WITH MG THAT BEARS THE MODEL AND SERIAL NUMBERS STATED ON THE INSTALLATION START UP RECORD, AND MG SHALL NOT, IN ANY EVENT, BE LIABLE UNDER THE TERMS OF THIS LIMITED WARRANTY UNLESS THIS INSTALLATION START UP RECORD HAS BEEN ENDORSED BY OWNER & DEALER/INSTALLER AND RECIEVED BY MG LIMITED WITHIN 90 DAYS OF START UP.

**Limitation:** This Limited Express Residential Warranty is given in lieu of all other warranties. If, not withstanding the disclaimers contained herein, it is determined that other warranties exist, any such express warranty, including without imitation any express warranties or any implied warranties of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Residential Warranty.

**LIMITATION OF REMEDIES** In the event of a breach of the Limited Express Residential Warranty, MG will only be obligated at MG's option to repair the failed part or unit, or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to MG's factory in Petitcodiac, New Brunswick of each defect, mal-function or other failure, and a reasonable number of attempts by MG to correct the defect, malfunction or other failure, and the remedy fails of its essential purpose, MG shall refund the purchase price paid to MG in exchange for the return of the sold good(s). Said refund shall be the maximum liability of MG. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR PURCHASER AGAINST MG FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR MG'S NEGLIGENCE OR IN STRICT LIABILITY.**

**LIMITATION OF LIABILITY** MG shall have no liability for any damages if MG's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, shortages of transportation, fuel, material, or labour, acts of God or any other reason beyond the sole control of MG. **MG EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR MG's NEGLIGENCE OR AS STRICT LIABILITY.**

**OBTAINING WARRANTY PERFORMANCE** Normally, the dealer or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any MG recognized distributor, dealer or service organization. If assistance is required in obtaining warranty performance, write or call: Maritime Geothermal Ltd • Customer Service • PO Box 2555 • Petitcodiac, New Brunswick E4Z 6H4 • (506) 756-8135 • or e-mail to info@nordicghp.com NOTE: Some states or Canadian provinces do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and from Canadian province to Canadian province. Please refer to the MG Installation, Installation and Service Manual for operating and maintenance instructions.

An extended warranty option is also available. Please contact Maritime Geothermal Ltd. via the contact information in the previous paragraph for more information.